

COLOR SORTING 4DOF ROBOTIC ARM WITH LIVE UPDATE USING MACHINE LEARNING ALGORITHM

Submitted in partial fulfilment of the requirements for the award of
**Bachelor of Engineering degree in
Electronics and Communication Engineering**

By
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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

SCHOOL OF ELECTRICAL AND ELECTRONICS

SATHYABAMA
INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)
Accredited with Grade “A” by NAAC
JEPPIAAR NAGAR, RAJIV GANDHI SALAI,
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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

BONAFIDE CERTIFICATE

This is to certify that this Project Report is the bonafide work of **VIGNESH MYNENI (37130434)** who carried out the project entitled “**COLORSORTING ROBOTIC ARM WITH LIVE UPDATE USING MACHINE LEARNING ALGORITHM**” under my supervision from SEPTEMBER 2020 to MARCH 2021.

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DECLARATION

I **VIGNESH MYNENI (37130434)** hereby declare that the Project Report entitled **“COLOR SORTING ROBOTIC ARM WITH LIVE UPDATE USING MACHINE LEARNING ALGORITHM”** done by us under the guidance of **Dr.R.NARMADHA ,M.E.,Ph.D.,** at **SATHYABAMA INSTITUTE OF SCIENCE AND TECHNOLOGY** is submitted In partial fulfilment of the requirements for the award of Bachelor of Engineering degree in Electronics and Communication Engineering.

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ABSTRACT

All sectors are being industrialised in the age of robotics and automation in order to achieve exponential growth and advancement. We present a robotic arm with a clever approach to incorporate sorting of items based on colour using a Machine Learning Algorithm in this project. The robotic arm can rotate like human hands to its predefined angles. The color detection is done by color sensor. Robotic arm is widely used and it is a preferred electromechanical machine for many applications it has similar functions of a human arm robotic arm functioning is base on sensors which pick and place object Here, We built a robotic arm that sorts small objects before picking and placing them in various boxes, and all data is modified via Bluetooth module. The device is kept up to date in real time thanks to the Bluetooth module that has been mounted. A microcontroller-based mechanism controls the robotic arm's base, elbow, wrist, and grip, as well as servo motors in the base, elbow, wrist, and grip.

CONTENTS

CHAPTER NO	TITLE	PAGE NO
	ABSTRACT	vi
	LIST OF FIGURES	vi
1	INTRODUCTION	1
	1.1 Introduction to robots	1
	1.2 Robotic Arm	1
	1.3 Overview	2
	1.4 Objective	2
2	Literature survey	3
	summary	4
3	AIM AND SCOPE OF PRESENT INVESTIGATION	5
	3.1 Block diagram of the proposed work	6
	3.2 What are robots	6
	3.3 Bluetooth low energy	6
	3.4 Bluetooth low energy architecture	6
	3.5 Robots	8
	3.6 Applications	8
	3.7 Industrial robots	8
	3.8 Domestic and household robots	9
	3.9 Medical robots	9
	3.10 Top six uses for robotics in field of medicine today	9
	3.11 Algorithm	10
	3.12 Circuit diagram	11
4	EXPERIMENTAL OR MATERIALS AND METHODS	12
	ALGORITHMS USED	
	4.1 Structure member	12
	4.1.1 Basic design	12
	4.1.2 Improved stability	12
	4.2 Electronic components	12

	4.2.1 AVR microcontroller	12
	4.3 Arduino	13
	4.3.1 Arduino nano	14
	4.3.2 Specifications	14
	4.3.3 Reason for using Arduino	15
	4.3.4 Arduino kit	16
	4.3.5 Analog to digital converter module	18
	4.3.6 Servo motor	19
	4.3.7 Servo motor SG90	22
	4.4 TCS 320 color sensor	22
	4.5 IR sensor	23
	4.5.1 IR sensor board	23
	4.5.2 IR Transmitter	25
	4.5.3 Obstacle sensing circuit IR sensor circuit	26
	4.5.4 Distinguish between black and white colors	27
	4.6 Bluetooth module HC-05	28
	4.6.1 Pin description	29
	4.6.2 Bluetooth description between devices	30
	4.6.3 Pair HC-05 and smartphone	30
	4.6.4 Command mode	31
	4.7 Power supply	33
	4.8 Proteus	35
	4.9 Arduino IDE	35
	4.10 Reinforcement learning	36
5	RESULTS AND DISCUSSION ,PERFORMANCE ANALYSIS	37
	5.1 Final result	38
6	SUMMARY AND CONCLUSION	41
	6.1 Future scope	41
	6.2 Conclusion	41

LIST OF FIGURES

FIGURE NO	TITLE	PAGE NO
1.1	Block diagram	6
1.2	Bluetooth low energy architecture	8
1.3	Algorithm for robotic arm	10
1.4	Circuit diagram	11
2.1	Nano front view	15
2.2	Nano rear view	15
2.3	Arduino kit	16
2.4	Arduino architecture	17
2.5	Working of servo	20
2.6	Inside a servo motor module	20
2.7	Variable pulse width control servo position	21
2.8	Servo motor SG90	22
2.9	Pulse wave modulation	22
2.10	Functional block diagram	23
2.11	TCS320 color sensor	23
2.12	IR Sensor	24
2.13	Infrared LED	25
2.14	Schematic diagram for IR transmitter	25
2.15	IR Sensing circuit	26
2.16	HC-05 Bluetooth module	29
2.17	Pin description	29
2.18	Bluetooth module serial interface	30
2.19	Block diagram of RPS	33
2.20	Output of RPS	34
3.1	Simulation result	37

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION TO ROBOTS:

The word robot refers to both real robots and automated machine agents, although the latter are commonly referred to as bots. There is no agreement about which machines count as robots, but analysts and the general public agree that robots maintain any or more of the following capabilities or roles.

1.2 ROBOTIC ARM:

A robotic arm is a form of mechanical arm that is normally programable and has capabilities similar to a human arm; the arm may be the entire instrument or it may be used for a more unpredictable robot. Joints bind the connections of such a controller, allowing rotational movement (for example, in a verbalised robot) or translational (direct) dislodging.

NASA uses autonomous weapons to transport massive objects into space. The "Canadarm" robot arm of the space bus first flew on the bus' second mission in 1981. The larger Canadarm2 is housed on the International Space Station. For certain positions, the space transport has used its arm. It may very well be used to launch or recover satellites. The arm, for example, has been used to snare the Hubble Space Telescope on five separate fix flights. To help construct the station, the bus and space station weapons collaborate. The station's mechanical weapons have been used to transfer new components into operation. During spacewalks, the weapons will also be used to pass space travellers across the station. The arm of the space station will travel around the station to reach different parts. Like an inchworm, it runs along the outside of the station, connecting at either end. It also has a Dextre, an artificial "hand" that can perform smallertasks. These controlled weapons can be controlled by a space explorer or someone in Mission Control. To pass the arm around, the space traveller uses regulators that look like joysticks from video games.

1.3 OVERVIEW:

This project is the secret to much of the precise work that humans can't perform repeatedly, and it's where a robotic arm, or as we'll call it, a pick - and-place robot, comes into play. Mechanical technology is the branch of engineering, electrical engineering, and registration that deals with the planning, production, operation, and use of robots, as well as computer systems for controlling, analysing, and storing data. A robotic arm may be a mechanical arm that is naturally programmable and has similar capacities to an individual's arm; the arm could also be the size of the device or a part of a more complex robot. Joints bind the links of such a controller, allowing rotational movement (for example, in an explained robot) or translational (direct) elimination.

1.3 OBJECTIVE:

- Colour based object sorting robotic arm using machine learning algorithm
- Designed a 4 degrees of freedom robotic arm(4DOF) and implemented machine learning algorithm in hardware
- With the help of Bluetooth low energy live update of the system is obtained

CHAPTER-2 LITERATURE SURVEY

2.1 LITERATURE SUMMARY:

Topic1: Design of fruit segregation and packaging machine

Reference:[2020 International Conference Computational Performance Evaluation (ComPE) Jul 2-4, 2020DOI:10.1109/comPE493225.2020.9199986]

Overview:

Automation, as the fundamental property in the agricultural field, enhances and strengthens the consistency, breadth, and productivity of manufacturing products. The rate of assessment has improved as a result of improved product sorting. Since sorting is one of the most significant market problems, a reliable sorting system was needed so that the items could be packaged automatically. Preprocessing, thresholding, segmentation, extraction, labelling, and detection are all properties used in this operation.

Topic2: Genetic algorithm based pick and place sequence optimization for a color and size sorting delta robot

Reference:[2020 4TH June international Conference on control automation and robotics DOI:10.1109/ICCAR49639.2020.9108045]

Overview: In industry, delta robots are used for light-weight material processing and sorting. A sequence optimising algorithm for a colour and size sorting delta robot is presented in this article. It finds the optimum path within the task space to perform a industry emulated scenario an open cv python program was developed to sort objects consistent with their color and sizes the static positional coordinates of the objects within the robot workspace are obtained using the program

Topic3: Low-cost vision space for pick and place application using camera and ABB industrial robots

Reference:[IEEE-49239 Approved on 1-3 july 2020
DOI:10.1109/ICCCNT49239.2020.9225522]

Overview: This paper introduces and discusses a vision-based pick and place robot that uses an ABB IRB 140 industrial robot and a web camera. The robot, which is sent directly from the company, lacks the intelligence to sense colour. This project employs a colour algorithm created in Matlab 2013 with the help of the image processing and computer vision toolbox.

Topic4: Machine Learning and its Emergence in the Modern World and its Contribution to Artificial Intelligence

Reference: [2020 International conference for Emerging technology (INCET) jun 5-7,2020]

Overview: Machine learning is described as the empirical analysis of a variety of algorithms and statistics, as well as models that can be used to generate or perform specific tasks. Because of the trends, these functions are often dependent on the dependability of the Interface. Machine learning, which is also known as a subclass of AI, allows the system to render or execute a variety of tasks without the need for any human intervention. This mechanism is also synonymous with automated success and self-learning since it is often used to detect multiple faults within an inbuilt system or programme and take the requisite measures to debug and run diagnostics in order to minimise errors to the greatest extent possible.

Topic5: Object color recognition and sorting robot based on OpenCV and machine visionReference:.[Jan 20-22 2020 IEEE 11th International Conference]

Overview: Intelligent recognition technology is a critical component of new intelligent handling systems and a significant research topic in AI. A quest scheme of "OpenCV-based colour recognition capture robot" is proposed for this project. Image identification, navigation technology, and manipulator instruments are used to sort and move targets of various colour characteristics, and machine vision is used to incorporate the three-axis truss manipulator framework.

DRAWBACKS AND MY METHODOLOGY:

Error rates are high on previous methodology which are upto upto 15 percentage to overcome this problem we have implemented ml algorithm so we can achieve reduction in error rate upto 2 percent and we have used reinforcement learning method Reinforcement Learning is thrown. When we, as humans, imagine tossing something at a target, we don't give it much thought; we simply chuck. The irony is that our brain is wired in such a way that when we throw, we don't have to think or calculate anything.

CHAPTER-3

AIM AND SCOPE OF PRESENT INVESTIGATION

The fundamental focal point of this venture was to plan and build up the component for mechanical arm for lifting. The automatic arm was designed with four stages of capability and adapted to perform a precise light material lifting task to assist the production line of every industry. The components of the mechanical arm are manufactured using a laser cutting strategy in this project. This resulted in more precise calculations as well as significant time and expense savings during the manufacturing process. The automatic arm is equipped with four servo engines that attach the components and allow the arm to move. Steel outlines that have spaces that suit the servo engine connect the automated arm joints. The controller has a sum of 4 level of opportunity excluding the gripper. It has five kind of revolution which is base turn, shoulder pivot, elbow pivot, wrist pivot and gripper revolution. The servo engines are appended to each joint dependent on the measure of force it can deliver. Arduino, an open-source PC equipment and programming is applied to control the mechanical arm by driving servo engines to be able to change the position. In this undertaking we gives a 4DOF mechanical arm a shrewdway to deal with carry out arranging of items based on shading utilizing Machine Learning Algorithm. The automated arm can turn like human hands to its predefined points. In a mechanics context, four degrees of opportunity are clear, characterised modes in which a mechanical device or structure may travel. The total number of free relocations or pieces of travel is equal to the number of degrees of opportunity. The word is commonly used to describe a robot's ability to drive. The shading discovery is finished by shading sensor and IR sensor. Shading based item arranging mechanical arm utilizing AI calculation. we Designed a 4 levels of opportunity automated arm (4DOF) and to diminish the blunder rate upto 1 percent we have executed AI calculation in equipment. With the assistance of Bluetooth low energy live update of the system is obtained

3.1.1 BLOCK DIAGRAM OF THE PROPOSED WORK

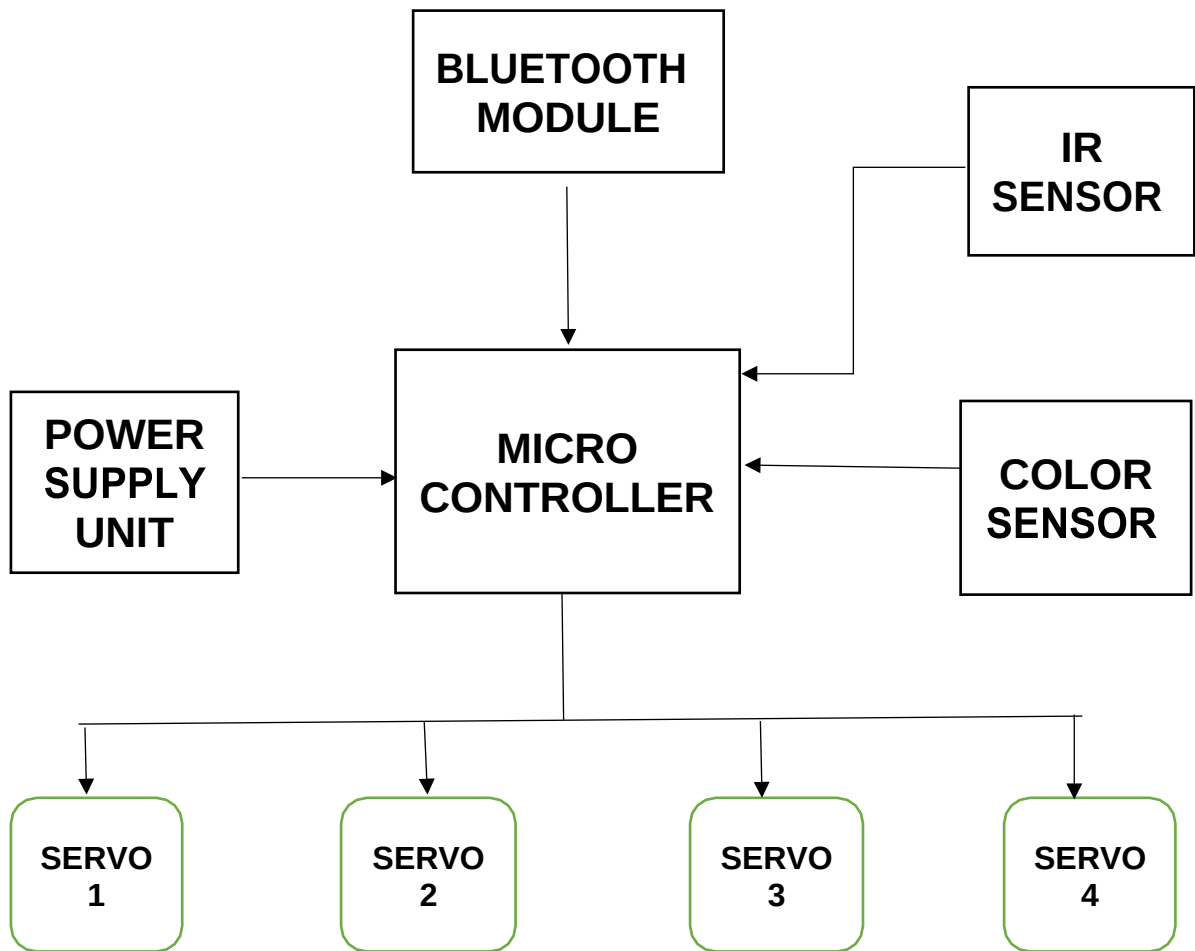


Fig: 1.1 block diagram

Robotics is a confluence between engineering and science that includes engineering, computation, and robotics. It is no longer an emerging discipline because it has developed too far in the past ten years and is approaching its apex. it's an ever growing field and lots of avenues have opened in recent past. The promise of robotics is straightforward to explain but hard for the mind to understand. A robot might be a mechanical or virtual shrewd specialist which will perform errands consequently or with direction, commonly by far off . By an d by a robot is ordinarily an electromechanical machine that is guided by PC and electronic programming. Robots hold the promise of moving and reworking materials with an equivalent ease as a computer virus transforms data. But the grey spot remains wide when it involves Research awareness within the field of Robotics and Automation. Sooner or later Robotics and automation will find its application in every facet of human life. The advancement in technology would bring each day of robots omnipresence. they' re going to soon sneak everywhere from gadgets to apparels and to our very own bodies. Hence it's the

responsibility of engineering community to disseminate the knowledge about the longer term scope and application of Robotics.

3.2 What are Robots?

The word "robot" comes from the Czech word "robota," which means "forced labour." Nobody has ever offered a definitive description of what a robot is, despite the fact that any of these meanings roughly translates to the same thing. to make life easier. "Robot may be a combination of electronics, mechanics and programming which senses it's surrounding through its sensors processes the sensor information and does something in response". Turning on an LED, pivoting a wheel, moving an arm, lifting a caution, and so on are all examples of velocity or control reactions. Robotics is a field of computing and engineering that deals with robot design, development, application, and service. It has uses in computing, physics, engineering, security, and even a variety of household products. Embedded systems, such as portable music players and mobile phones, have a controller built in to execute basic tasks.

3.3 Bluetooth Low Energy (BLE): It is a low-power wireless system that allows computers to communicate with one another. BLE uses the 2.4 GHz ISM (Industrial, Scientific, which Medical) band and is aimed at devices that need less electricity and can run on batteries for months or even years.

3.4 Bluetooth Low Energy Architecture: Bluetooth began as a tool for replacing short-distance cables. For example, in devices like a mouse, keyboard, or a PC communicating with a personal digital assistant (PDA) that were common in the late 1990s and early 2000s, to swap wires in devices like a mouse, keyboard, or a PC communicating with a PDA. Ericsson launched the first supported version of Bluetooth in 1994. King Harald "Bluetooth" Gormsson of Denmark is credited with bringing together war forces in the tenth century CE.

- **Physical layer:** The physical layer (PHY) refers to the real radio that is used for communication and data regulation/demodulation. It operates within the ISM band (2.4 GHz range).

- **The link layer:** is the layer that communicates with the Physical Layer (Phone) and instructs the higher levels about how to interact with the radio (via a go-between layer called the HCI layer, which we'll discuss shortly). It's in charge of coping with the radio's state, as well as clinging to the Bluetooth Low Energy information, since the situation necessitates it.

- **Direct Test Mode:** the point of this mode is to check the activity of the radio at the actual level, (for example, transmission power, recipient affectability, and so on)

- **The Host Controller Interface (HCI)** The host layer is a basic convention defined by Bluetooth that enables the Host layer to communicate with the Controller layer. These layers could be on separate circuits, or they could be on the same chip.

The Logical Connection Control and Adaptation Protocol (L2CAP) layer serves as a multiplexing protocol. It collects a variety of conventions from the upper layers and

stores them in regular BLE packets that are transferred down to the layers underneath it.

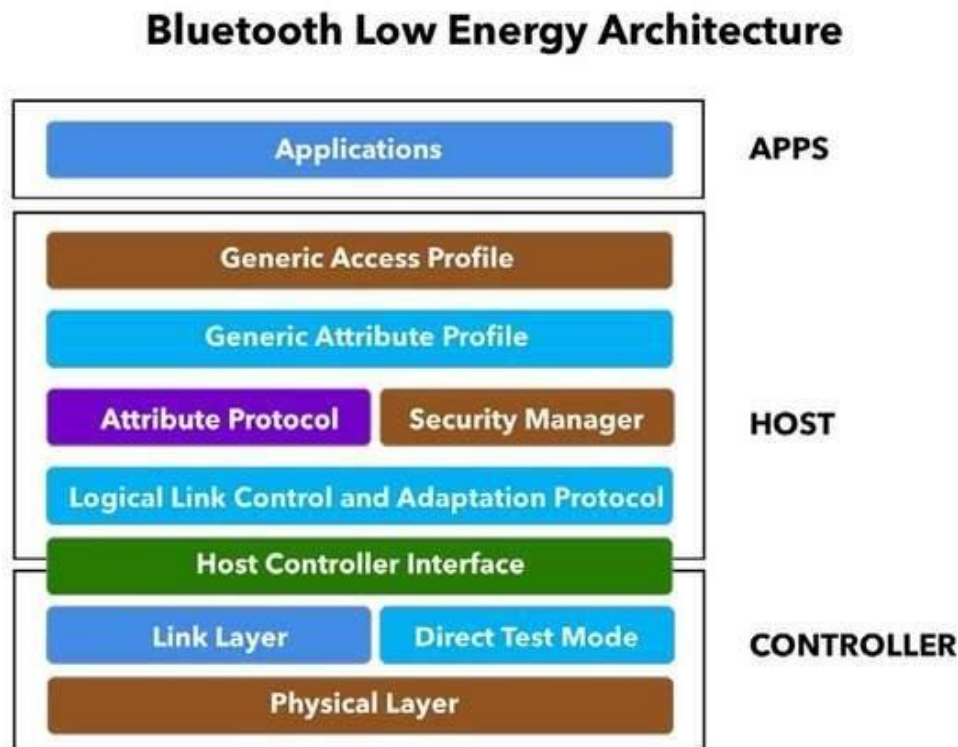


Fig1.2:Bluetooth low energy architecture

3.5 Robots:

Robots are hypothetically extraordinary in that they're furnished with sensors to see their current circumstance and actuators to perform specific assignments and may take insightful choices. Despite the fact that robots and inserted frameworks have all the earmarks of being two limits of designing world, the hole between them is diminishing. We definitely realize that clothes washers can detect soil in materials and takes savvy choices. Forced air systems can detect outside temperature and change interior temperature . These are smart installed frameworks worked inside another greater framework which sees it climate through its sensors and makes remedial moves, in this manner controlling the bigger framework

3.6 Applications:

Robots are now conducting a wide range of tasks in a variety of areas, and the number of tasks assigned to robots is increasing logically. The least complicated as a result of dividing robots into types could be a parcel by their use.

3.7 Industrial robots: In an industrialised assembly setting, modern robotics come into action. Typically, they are articulated weapons designed for tasks such as material handling, painting, welding, and other similar tasks.

3.8 Domestic or household robots:

Various pinion wheels are used in robots that are used at home, such as mechanical pool cleaners, automatic sweepers, mechanical vacuum cleaners, mechanical sewage cleaners, and other robots that can perform various family errands.

3.9 Medical robots:

Existing innovations are being included better approaches to smooth out the effectiveness of medical care activities. Subsequently, a sizable number of robots are being developed to assist in those roles within the healthcare setting. Careful robotics and rehabilitation robots are among the robots that serve in human therapy. In addition, the market for assistive and rehabilitation robotic systems is increasingly expanding. Robots that assist patients in rehabilitating from medical illnesses such as strokes, empathic robots that assist in the treatment of elderly or physically/mentally ill people, and mechanical robots that combat a variety of repetitive tasks, such as sanitising rooms and sound system representation, are among them, along with extended reality.

3.10 top six uses for robots in the field of medicine today:

1. Telepresence: Doctors use robotics to examine and treat patients in rural or remote areas, allowing them to "telepresence" within the hospital. Experts are commonly available to respond to questions and direct care from remote locations through the robot; key features of these mechanical devices include route capability within the (ER) and confounded cameras for the actual evaluation.

2. Surgical Assistants: These remote-controlled robots assist experts in completing tasks in a minimally invasive manner. "The ability to control a highly advanced mechanical arm using working controls located at a workstation outside of the OR is a sign of careful robots," says one expert. "Additional applications for these careful associate robots are constantly being created, as further developed 3DHD technology gives specialists the spatial references required for extremely complex medical procedures, including more implementations

3. Rehabilitation: These play an important role in the recovery of people with disabilities, such as increased mobility, resilience, coordination, and personal fulfilment. This robots are often designed to adjust to each patient's situation when they recover from strokes, traumatic brain or medulla spinalis disorders, or neurobehavioral or neuromuscular diseases such as MS. Balance, driving, and other motor skills can all be improved by playing a video game with therapy robots.

4. Medical: in the medical sector This robots provide supplies, medications, and meals to patients and nurses, facilitating communication with doctors, emergency clinic staff members, and patients. "Most of those robots have deeply dedicated capacities for self navigation in the force," ManojSahi, a pursuit specialist with Tractica, a business insight company that focuses on creativity, says. "However, there is a need for highly

advanced and realistic indoor path systems that support sensor combination field advancement to improve the navigational abilities of transportation robots."

5. Sanitation: With the ascent in anti-infection safe microorganisms and flare-ups of lethal diseases like Ebola, more medical services offices are utilizing robots to wash and clean surfaces. "At present, the main techniques utilized for sterilization are UV light and peroxide fumes," says Sahi. "These robots can clean a space of any microbes and infections in no time."

Robotic Arms has a wide production spectrum. In the not -too-distant future, weapons will be capable of doing any job that humans do, and in a much better manner. The only limit to its possible applications is one's imagination. It is frequently a lifesaver for handicapped individuals who have been paralysed or have lost their hands due to an injury. The arm is often taught to focus on a person's order and execute the duty. It is also possible to use a gesture-controlled device. Wearable sensors are sometimes used to transmit commands and monitor arm motions. BCI (Brain Computer Interface) is a rapidly growing area of study. BCIs are often used to collect impulses from the brain and activate the limb. The machine will add in the same way as a human arm can. Such artificial arms enable a person who has lost his hand in an accident to regain his life as before. Robotic weapons are adaptable and can be used in a variety of ways.

3.11 Algorithm for robotic arm:

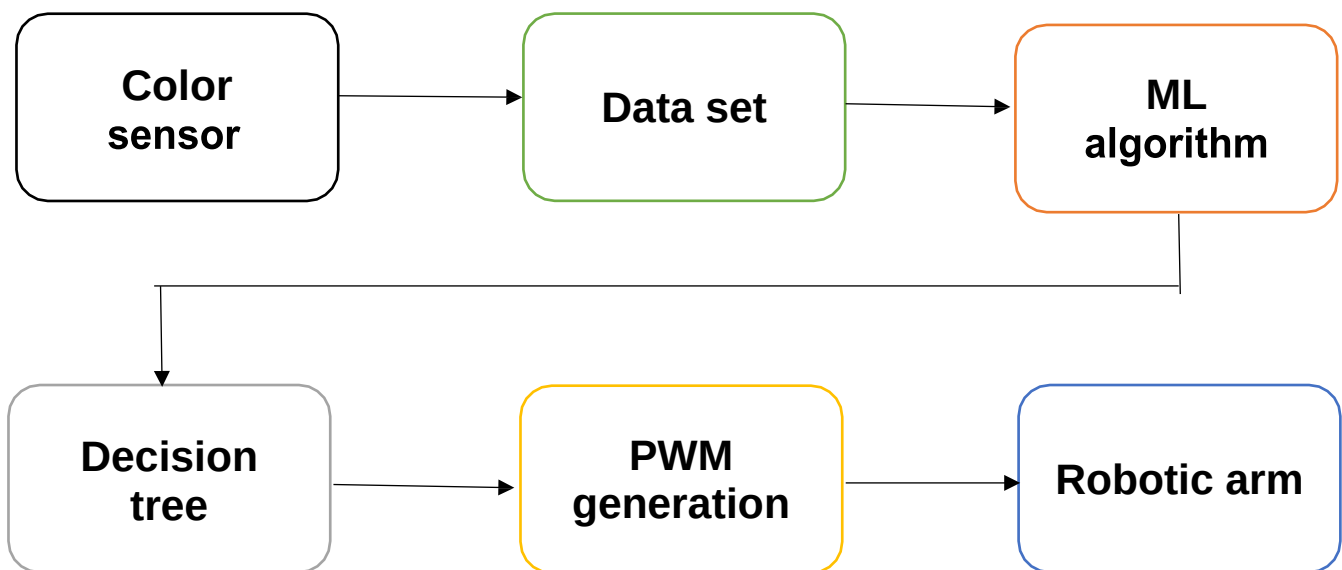


Fig: 1.3 :algorithm for robotic arm

The tcs320 colour recognition sensor module employs a high-quality light sensor that can detect any colour by combining red, green, and blue to detect the target and align it to the data collection set . A data set is a collection of sensor values used for ml algorithm it is a sort of man-made brainpower that concentrate designs out of crude informational collection by utilizing a calculation or technique. ML's main goal is to enable computers to learn from their mistakes without having to be directly programmed or have human interference in the data set . which is already included in ML algorithm matches it and once when the data set gets matched the functions of the decision tree One of the statistical modelling methods used in statistics data mining and learning is decision tree learning. The duty cycle of a square wave is varied when the time is set in a pulse width modulation signal generator, and the robotic arm operates as a result. An artificial arm is a mechanical arm that can be programmed to perform tasks identical to those of a human arm.

3.12 Circuit diagram:

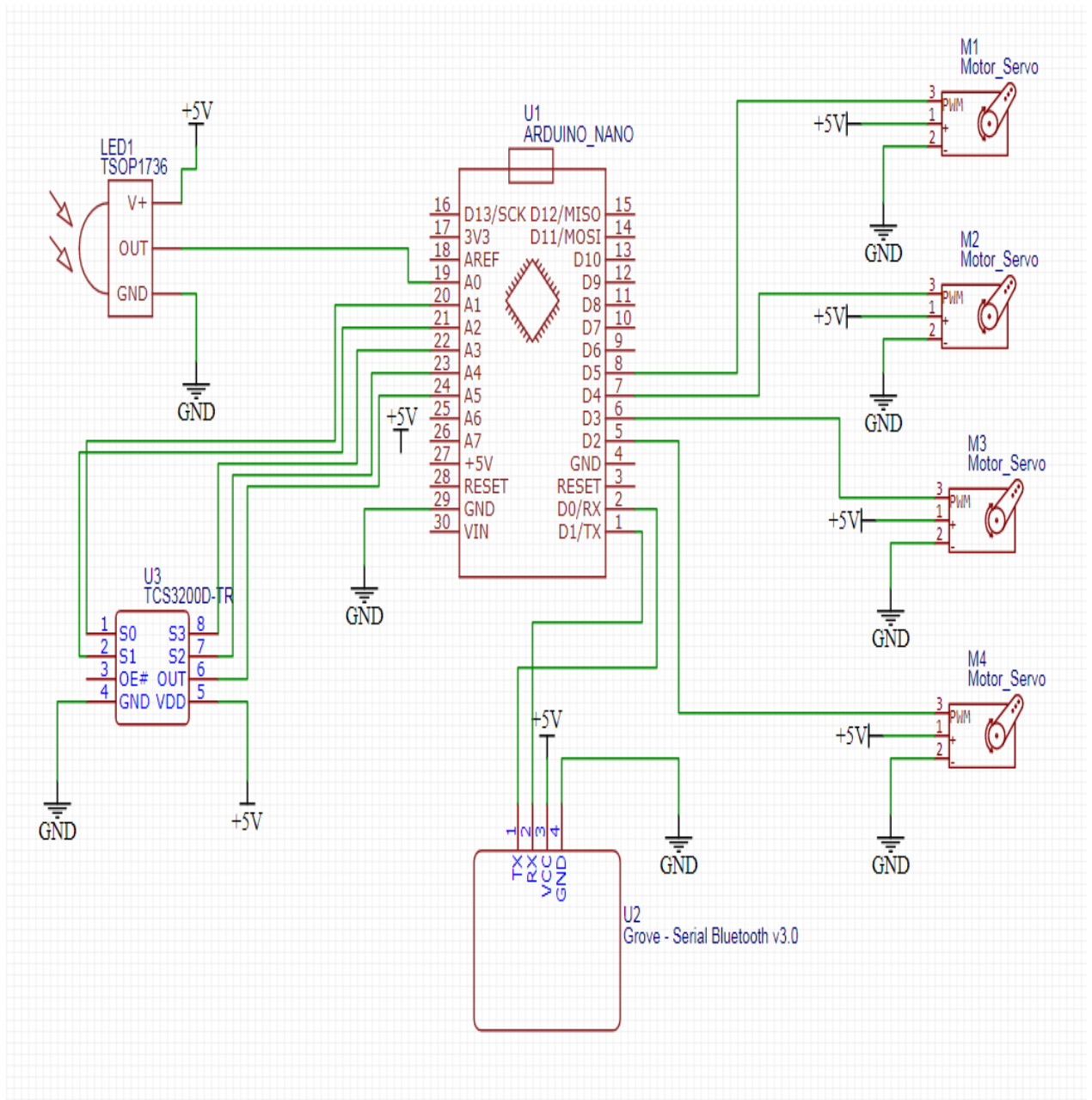


Fig 1.4: circuit diagram

Chapter-4

Experimental or materials and methods algorithms used

4.1. Structure Member:

4.1.1. Basic design: The structure member is robustly designed and built with Aluminum and plywood for improved strength. The structure member is Cartesians type (box) built where aluminum channel form the basic structure along all the axis and plywood become the base. The Dimension of the frame includes 410mm*360mm. the plywood dimension forms a thick Block of 520mm*520mm*18mm. all the frame members are tightened using Fasteners and rigid bold are wont to fix the most frame with the bottom

4.1.2. Improved Stability: The structure member is designed in such a way that can withstand the vibration and deformation created during the quick acceleration of the driver system. column can withstand a maximum load of 1 kg with factor of safety and faster can able to withstand a vibration of amplitude 12.36mm. to prevent deformation of frame will cause dimension error while printing the material is pretested and fastened

4.2 Electronic components:

4.2.1 AVR Microcontroller:

An AVR microcontroller is a type of processor made by Atmel that has advantages over other popular chips. The most straightforward way to think about it is to pair a microcontroller with our PC's motherboard. A microprocessor (Intel, AMD chips) that provides intelligence, RAM and EEPROM memories, and interfaces to the rest of the device, such as serial ports (mostly USB ports now), disc drives, and monitor interfaces, can be found on the motherboard. A microcontroller has all or a significant portion of such highlights built into one chip, eliminating the need for a motherboard, and a large number of segments, such as LEDs, are often connected to the AVR.

AVR microcontrollers are available in a variety of packages. Some are designed for through-opening mounting, while others are surface mount. Despite the fact that anything 64-pin or more is surface mount, AVRs are available with 8-pins to 100-

pins. A lot of people begin with a DIL (Dual In Line) 28-pin chip, such as the ATmega328 or the 40-pin ATmega16 or ATmega328. The combination of FLASH, EEPROM, and SRAM on a single chip eliminates the need for external memory in many applications. A few gadgets have an equivalent external transport option to allow for the addition of additional information memory or memory-planned devices. the majority of gadgets (with the exception of the tiniest Tiny AVR chips) provide sequential interfaces that are commonly used to link larger sequential EEPROMs or glimmer chips.

Key Features:

- 32 x 8 general working purpose registers.
- 32K bytes of in system self programable flash program memory
- 2K bytes of internal SRAM
- 1024 bytes EEPROM
- Available in 40 pin DIP, 44 lead QTFP, 44-pad QFN/MLF
- 32 programmable I/O lines
- 8 Channel, 10 bit ADC
- Two 8-bit timers/counters with separate prescalers and compare modes
- One 16-bit timer/counter with separate prescaler, compare mode and capture mode.
- 4 PWM channels
- In system programming by on-chip boot program
- Programmable watch dog timer with separate on-chip oscillator.
- Programmable serial USART
- Master/slave SPI serial interface

4.3 Arduino:

Arduino is an open-source gadgets platform for easy-to-use hardware and programming. Arduino sheets are programmed to recognise inputs - such as a light on a sensor, a finger on a catch, or a Twitter post - and convert them into outputs - such as starting a motor, flipping on a light, or disseminating information on the internet. By submitting a set of instructions to the board's microcontroller, you'll tell it what to try to do. to make an effort to use the Arduino programming language (in light of wiring), and hence the Arduino programming (IDE) supported preparation

Arduino sheets have long served as the brains behind a wide range of projects, from simple household objects to sophisticated logical instruments. An entire community of developers - understudies, specialists, craftsmen, software engineers, and experts - has gathered around this open-source platform, and their contributions have amounted to an enormous volume of open knowledge that would be of tremendous help to both novices and experts.

Arduino was created at the Ivrea Interaction Design Institute as a simple tool for rapid prototyping aimed at students without a background in electronics or programming. The Arduino board started evolving to adapt to new needs and challenges as soon as it reached a larger local market, splitting its offering from simple 8-digit sheets to products for IoT devices, wearables, 3D printing, and embedded conditions. Both Arduino sheets are completely open-source, allowing customers to create them at their leisure and then customise them to their individual needs. The software is open-source, and it is being developed thanks to the contributions of clients all over the world.

4.3.1 Arduino nano:

The Arduino Nano is a small, full, and breadboard-compatible board powered by an ATmega328 (Arduino Nano 3.0) or ATmega168 microcontroller (Arduino Nano 2.x). It's almost the same functionality as the Arduino Duemilanove, but in a different package. It only needs a DC power jack and uses a Mini-B USB connection rather than a standard one. Gravitech is planning and developing the Nano.

4.3.2 Specifications:

- Microcontroller: ATmega328
- Operating Voltage: 5V
- Input Voltage (recommended): 7-12V
- Input Voltage (limits): 6-20V
- Digital I/O Pins: 14 (of which 6 provide PWM output)
- Analog Input Pins: 6
- DC Current per I/O Pin: 40 mA
- DC Current for 3.3V Pin: 50 mA
- Flash Memory: 32 KB of which 0.5 KB used by bootloader
- SRAM: 2 KB (ATmega328)

- EEPROM: 1 KB (ATmega328)
- Clock Speed: 16 MHz

The Arduino Nano is normally powered by a Mini-B USB connection, a 6-20V uncontrolled external force supply (pin 30), or a 5V guided external power supply (pin 27). The office source is, of course, set to the highest voltage possible. If the Nano is powered by USB, the FTDI FT232RL chip on the board is simply operated. As a result, when operating on non-USB input, the 3.3V output (provided by the FTDI chip) is unavailable, causing the RX and TX LEDs to flicker if digital pins 0 or 1 are high.



Fig 2.1: Nano Front view

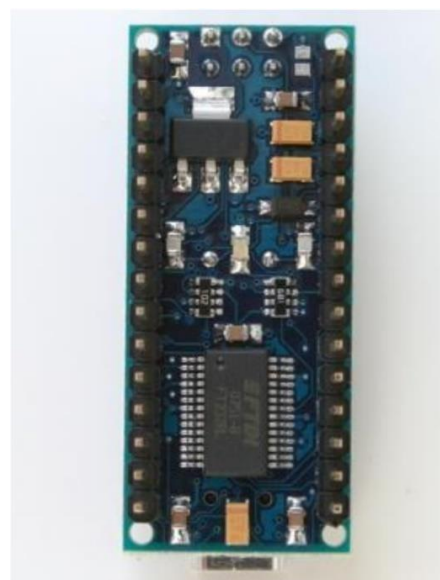


Fig 2.2: Nano rear view

4.3.3 Reason for using Arduino:

- Affordable - As compared to other microcontroller levels, Arduino sheets are reasonably priced. The least expensive version of the Arduino module is frequently collected by hand, and the pre-assembled Arduino modules, interestingly, cost just \$50.

Cross-platform - The Arduino Software (IDE) is compatible with Windows, Macintosh OSX, and Linux operating systems. The majority of microcontroller frameworks are only available for Windows.

- Easy-to-use programming environment- The Arduino Software (IDE) is simple to use for beginners, but adaptable enough for cutting-edge clients to take

advantage of as well. It's advantageously supported the Processing programming environment for educators, so understudies learning how to programme in that environment would be familiar with how the Arduino IDE works.

- Extensible and open source programming - Arduino programming is made available as an open source device, enabling professional users to customise it. C++ libraries are often introduced to the language, and those interested in learning more about the specialised specifics can move from Arduino to the AVR C programming language. You can also use AVR-C programming directly in your Arduino programmes if that's what you want.
- Open source and extensible hardware - The Arduino sheets' plans are released under a Creative Commons licence, allowing professional circuit designers to create their own version of the module, extending and developing it. Indeed, even the most inexperienced clients will create the module's breadboard adaptation and learn how it works and streamline.

4.3.4 arduino kit:

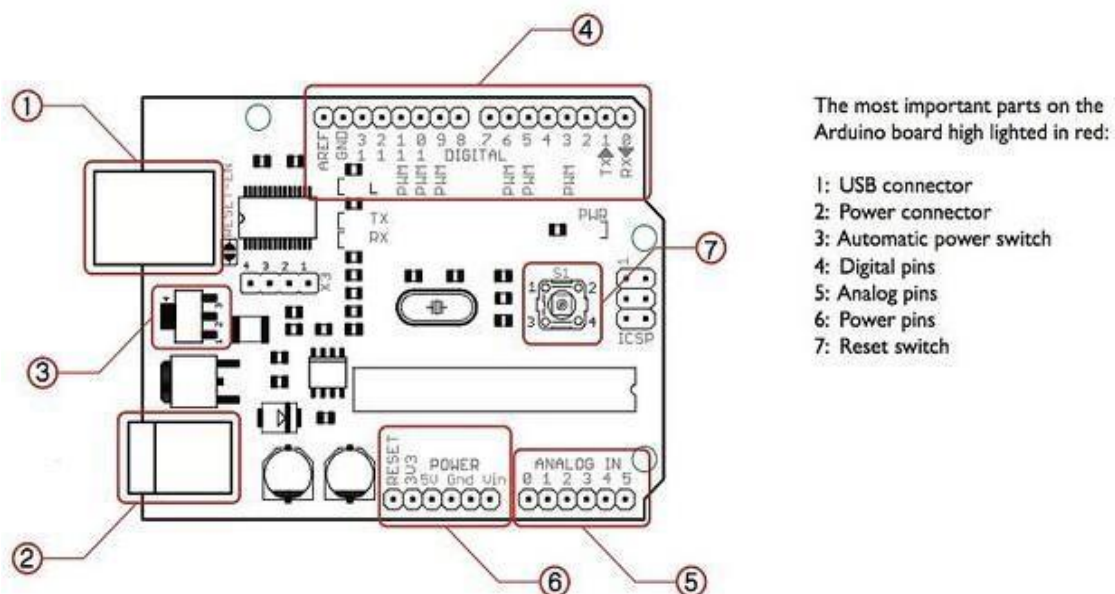


Fig 2.3 :Arduino kit

Architecture:

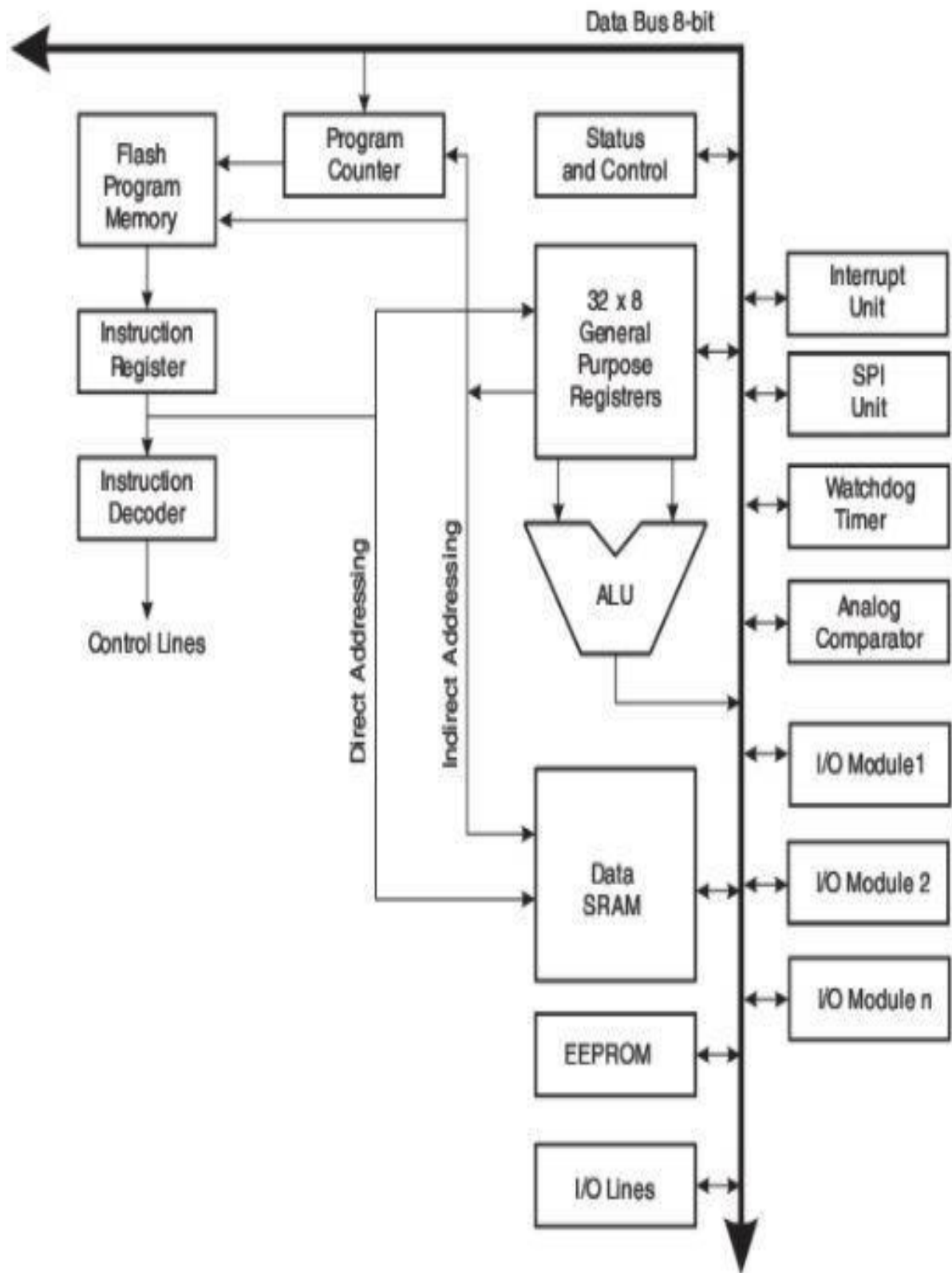


Fig 2.4: Arduino architecture

4.3.5 Analog to digital converter module:

An ADC evaluates a basic waveform over a set of time intervals and assigns a numerical value to each example. In a parallel coded design, the computerised value appears on the converter's output. The value is calculated by subtracting the reference voltage from the tested basic information voltage and multiplying by the number of computerised codes. The yield code's quantity of twofold parts determines the converter's target. The inspection and quantisation cycles are completed by an ADC.

A basic sign with an unlimited target is addressed by the ADC as a computerised code with a small goal. The ADC generates $2N$ computerised values, with N referring to the number of paired yield bits. Since the converter has a small target, the basic knowledge will slip between the quantization stages, resulting in a characteristic vulnerability or quantization blunder. This error determines the converter's most serious special scope. The inspecting loop deals with an indefinite time area signal with values measured at discrete and uniform time intervals. According to Nyquist Theory, this loop determines the signal's most intense propagation power. This theory states that the symbol recurrence should be satisfactory to one with a significant portion of the recurrence to stop associating. Associating is a situation under which recurrence signs outside of a fixed symbol band appear within the transmission speed of interest as a result of the testing interaction.

This associating relationship is, however, often exploited in interchange systems configuration to down-convert a high recurrence sign to a lower recurrence sign. This system is thought to be under-tested.

The ADC's information data transmission capability and complex scope are sufficient to accumulate the very best recurrence sign of interest, which is an indicator of under-testing. Inspection and quantization are important concepts because they set the stage for the presentation of an optimal ADC's farthest ranges. The code changes in an optimal ADC are divided by one least important piece (LSB). There are $2N$ codes and $1 \text{ LSB} = FS/2N$ for an N -cycle ADC, where FS is the full-scale basic information voltage. Nonetheless, ADC operation around the

world is subject to non-ideal effects, which result in errors beyond those caused by converter target and test rate. These errors can be seen in a variety of AC and DC performance parameters for ADCs. Any analogue input code within this set corresponds to a digital output code.

When configuring and using the ADC the following functions must be considered.

- Port configuration
- Channel selection
- ADC voltage reference selection
- ADC conversion clock source
- Interrupt control
- Results formatting

4.3.6 Servo motor:

Three wires or leads are used in servo motors. Ground and positive inventory are supplied to the servo DC engine through two of those wires. The control signal is carried on the third cable. A servo engine's wires have been shade-coded. The red wire is the DC supply lead, and it can be connected to a DC voltage supply between 4.8 and 6 volts. The dark wire serves as a grounding wire. For various manufacturers, the tone for the third wire (which provides the power signal) varies. It is typically yellow (if Hitec occurs), white (if Futaba occurs), earthy coloured, and so on. Futaba provides a J-type socket with an extra rib for proper servo association. Hitec is an S-type connector. By removing the extra spine, a Futaba connector is commonly used for a Hitec servo. A Hitec connector is often often used with a Futaba servo simply by documenting the extra width all together so it blends in well. The Hitec splines have 24 teeth, while the Futaba splines have 25. As a result, splines designed for one servo form cannot be used for another. A servo arm is associated with a spline. Its shaft is similar to that of a normal DC engine. Servo engines have been available for a long time and are used in a variety of applications. They are small in scale, but they appear out of nowhere and are very energy-efficient. These features allow them to operate remote-controlled or radio-controlled toy cars, robots, and planes. Modern applications, specialised mechanics, in-line assembly, pharmaceuticals, and food administrations all use servo motors. The servo

hardware is built right inside the engine unit and features a movable shaft that is normally equipped with a gear (as shown below). The motor is operated by an electrical signal that defines the amount of shaft movement.

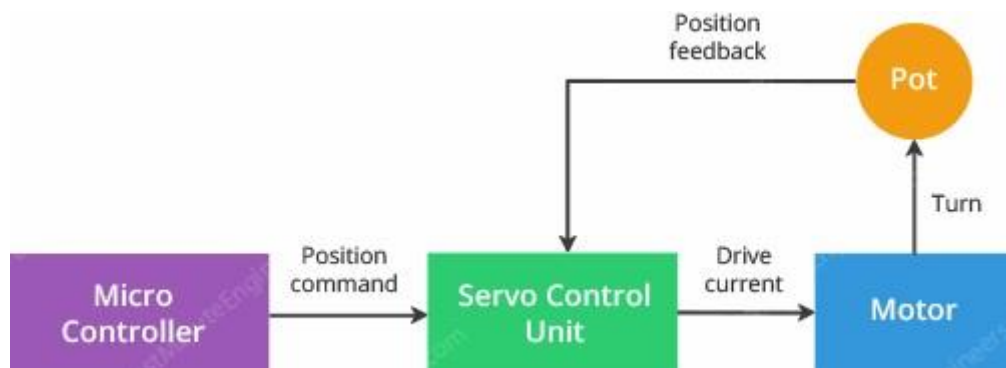


Fig 2.5: working of servo

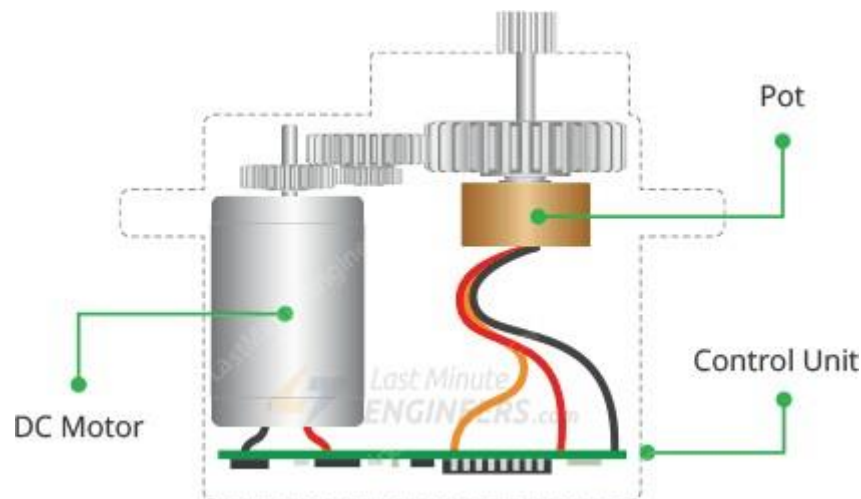


Fig 2.6: inside servo motor module

A closed-loop mechanism is often referred to as a servo. It's a closed-loop mechanism that uses the input signal to control the motor's speed and trajectory in order to achieve the desired effect. A RC servo motor operates on a similar principle. It has a small DC motor that is attached to the output shaft by gears. A servo arm is driven by the output shaft, which is often attached to a potentiometer (pot). The servo control unit receives location criticism from the potentiometer, which compares the actual engine condition to the desired position. dependable with the error, the control unit corrects the engine's particular condition so that it aligns with the objective location. Servos are constrained by transmitting a variable-width electrical pulse, also known as pulse width modulation (PWM), through the control cable. There's a reiteration rate, a base heartbeat, and a greatest heartbeat. A servo engine may usually only turn 90 degrees one way or

the other for a total of 180 degrees of production. The unbiased position of the engine is described as the point at which the servo has a similar measure of predicted turn in both the clockwise and counter-clockwise directions. The PWM transmitted from the engine determines the shaft's location and maintains the duration of the heart beat sent through the control wire; the rotor will handle the predefined location. Every 20 milliseconds (ms), the servo engine aims to detect a pulse, and the duration of the heartbeat can determine how far the engine turns. A 1.5ms heartbeat, for example, would cause the engine to address the 90° spot. More than 1.5ms turns the servo in a counterclockwise direction toward the 0° position, and more than 1.5ms turns it in a clockwise direction toward the 180° position.

When these servos are told to drive, they will move to the specified location and remain in that spot. In the event that an outside force presses against the servo when it is maintaining an edge, the servo will resist shifting out of that position. The force rating of a servo is the most drastic indicator of strength that it can apply. Servos, on the other hand, would not always remain in place; the spot beat should be rehashed to teach the servo to stay in place.

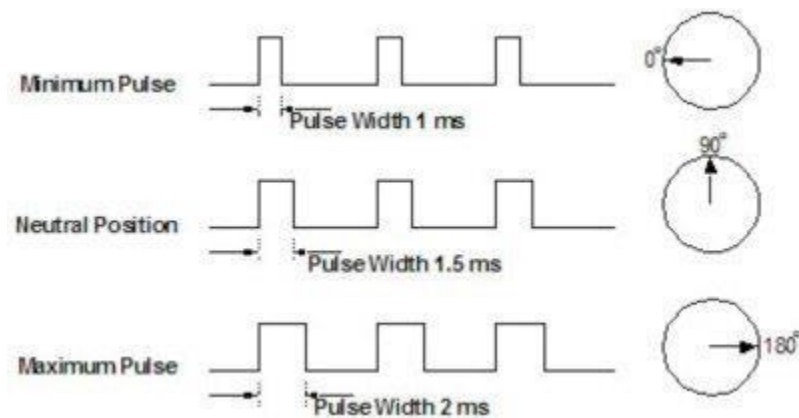


Fig 2.7: Variable Pulse width control servo position

4.3.7.Servo motor SG90:

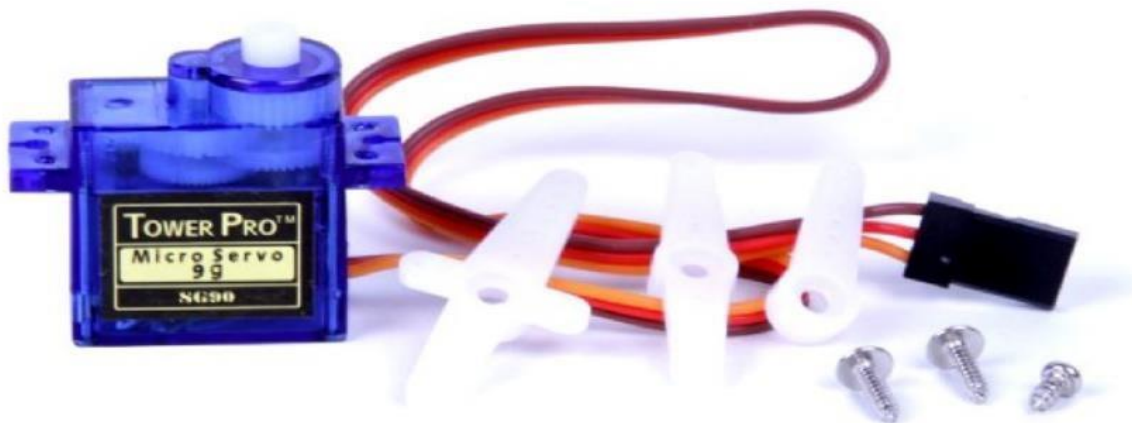


Fig 2.8: Servo motor SG90

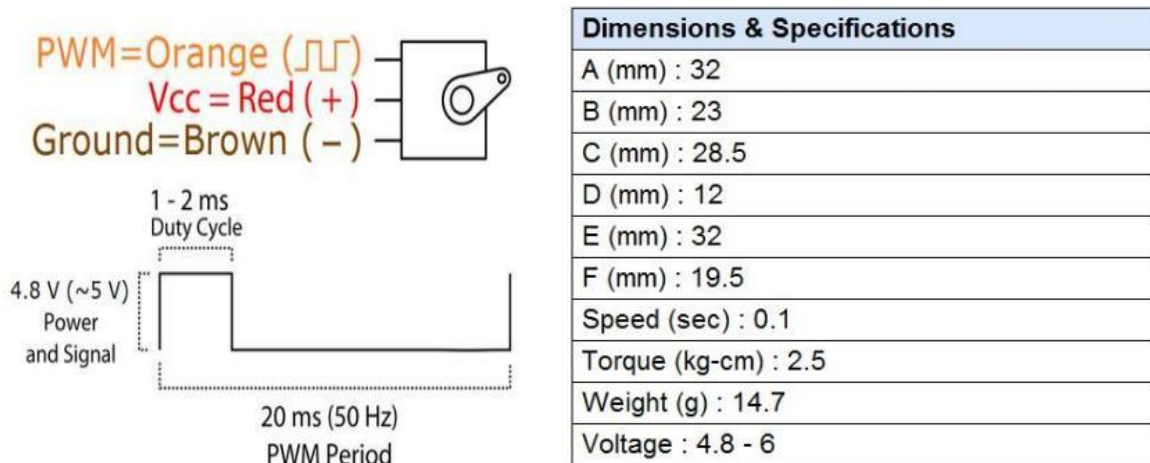


Fig 2.9: pulsewave modulation

With a high performance speed, it's small and compact. The servo can rotate about 180 degrees (90 degrees in either direction) and operates in a similar way to the quality sorts, albeit with less features. To monitor these servos, you can use any servo code, tools, or library. It's especially useful for newbies who need to shift things around without having to instal an engine regulator with input and stuff box, since it can fit in small spaces. It comes with a 3 (arms) and some gear.

4.4 TCS320 color sensor:

Comfortable Silicon Photodiode and Current-to-Frequency Converter are combined on a single solid CMOS coordinated circuit in the TCS320 Programmable Color Light-to-Frequency Converters. The yield is a square wave

(half duty cycle) with a recurrence directly proportional to the force of light (radiation). Via two control input pins, the full-scale yield recurrence can be extended by one of three preset qualities. Advanced data sources and computerised outputs make it simple to connect to a microcontroller or other logic hardware. Enable Yield (OE) In a high-impedance condition, a microcontroller provides yield for several units sharing the information path. The light-to-recurrence converter in the TCS3200 examines photodiodes of 8 x 8 exhibits. Blue channels are present in 16 photodiodes, green channels are present in 16 photodiodes, red channels are present in 16 photodiodes, and no channels are present in 16 photodiodes. The light-to-recurrence converter in the TCS320 looks at 4 x 6 different photodiodes. Blue channels are present in six photodiodes, green channels are present in six photodiodes, red channels are present in six photodiodes, and no channels are present in six photodiodes. To of the effect of non-homogeneity of occurrence radiation, four types (shades) of photodiodes are interconnected. Both photocodes of the same tone are related in the same way. Pins S2 and S3 are used to select which photodiode group (red, green, blue, or clear) is active. The photodiodes are 110 m x 110 m in dimension and have a focus of 134 m.

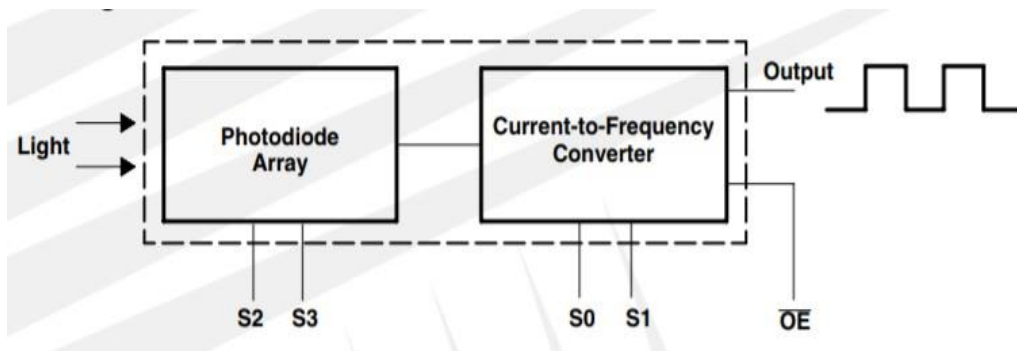


Fig :2.10: Functional block diagram

Configuration:

- High-Resolution Conversion of Light Intensity to Frequency
- Programmable Color and Full-Scale Output Frequency
- Communicates Directly With a Microcontroller
- Single-Supply Operation (2.7 V to 5.5 V)
- Power Down Feature
- Nonlinearity Error Typically 0.2% at 50 kHz

- Stable 200 ppm/°C Temperature Coefficient
- Low-Profile Lead (Pb) Free and RoHS Compliant Surface-Mount Package



Fig 2.11: TCS320 color sensor

4.5 IR sensor:

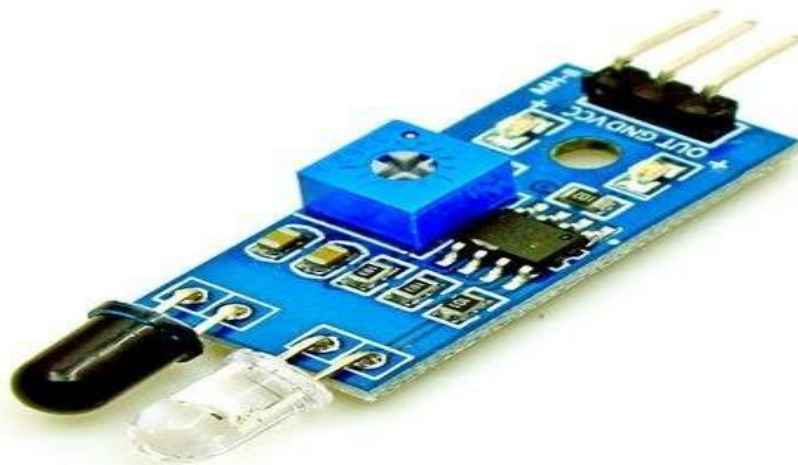


Fig 2.12: IR sensor

4.5.1 IR Sensor Board:

1. Latent or dynamic infrared sensors are common. Infrared locators are the foundation of latent infrared sensors. Uninvolved infrared sensors do not use an infrared source and detect energy emitted by obstructions within the field of

vision. There are two types of them: quantum and warm. Warm infrared sensors make use of infrared energy because it is a source of temperature and is frequency independent. Warm infrared locators commonly have thermocouples, pyroelectric finders, and bolometers.

2. Quantum sort infrared locators are faster than warm sort infrared locators in terms of detection execution. Quantum style locators' photosensitivity is reliably frequency subordinate. They are divided into two categories: inborn and outward. Photoconductive and photovoltaic cells are two types of natural quantum markers.

3. Infrared sensors that are active have two parts: an infrared source and an infrared finder. A LED or an infrared laser diode is used in infrared sources. Photodiodes or phototransistors are used in infrared finders. The infrared source's energy is reflected by an object and lands on the infrared identifier.

4.5.2 IR Transmitter:

A light emitting diode (LED) that emits infrared radiations can be used as an infrared transmitter. As a result, they're known as IR LEDs. While an IR LED appears to be a regular LED, the radiation it emits is invisible to the naked eye.



Fig. 2.13 Infrared LED

Infrared transmitters are classified according to their wavelengths, output capacity, and reaction time. An infrared LED, a current limiting resistor, and an effect supply are often used to make a simple infrared transmitter. A standard IR transmitter's schematic is shown below.

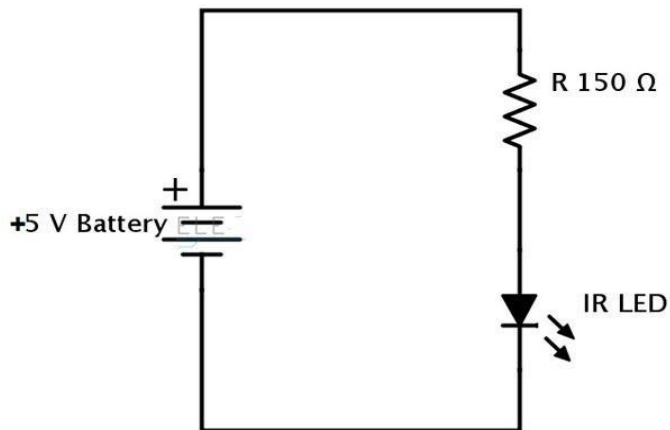


Fig 2.14: schematic diagram for IR transmitter

- The IR transmitter absorbs around 3 to 5 mA of current when powered by a 5V source. Infrared transmitters are tweaked on a daily basis to have a specific frequency of infrared.
- IR transmitters are frequently used in a few systems. • OOK (ON – OFF – KEYING) equilibrium is the most often used control. Infrared heating is needed in a few applications, and the best infrared source in this case is an infrared transmitter. Sun-based cells are commonly generated when infrared producers are combined with Quartz.

4.5.3 Obstacle Sensing Circuit or IR Sensor Circuit:

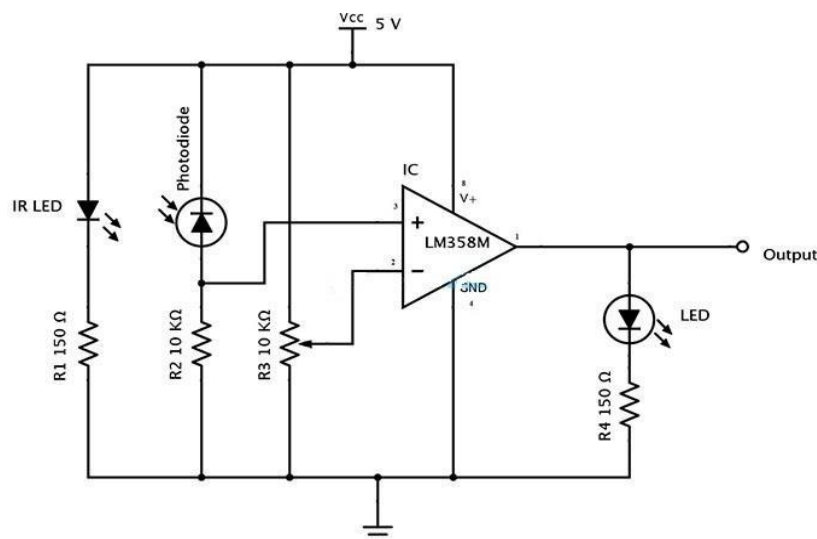


Fig 2.15: IR Sensing circuit

An IR LED, a photodiode, a potentiometer, an IC Operational amplifier, and an LED make up this circuit. The photodiode detects the infrared emitted by the IR LED. As a voltage comparator, an IC Op – Amp is used. The potentiometer is used to fine-tune the sensor's yield to meet the requirements.

When the IR LED's light is incident on the photodiode after touching an object, the photodiode's opposition falls from a high value. One of the contributions of the operation – amp is at the potentiometer's limit value. The structure resistor of the photodiode makes a negative addition to the process amp. The decrease around the structure resistor would be high when the incident radiation is higher on the photodiode. Both the edge voltage and, as a result, the voltage around the arrangement resistor are considered in the IC. The yield of the IC Op – Amp is high if the voltage around the resistor structure to photodiode is greater than the edge voltage. It becomes easier because the IC's yield is linked to an LED. Depending on the environmental conditions, the edge voltage is constantly modified by adjusting the potentiometer. The location of the IR LED and, as a result, the IR Receiver is crucial. This arrangement is known as Direct Incidence since the IR LED is held directly in front of the IR collector. In this scenario, almost all of the IR LED's radiation would land on the IR collector. As a result, there is direct contact between the infrared transmitter and the receiver. If an object comes into contact with this line, it either reflects or absorbs the radiation, preventing it from reaching the receiver.

4.5.4 Distinguishing Between Black and White Colors:

It is universally accepted that black colour absorbs all incident radiation while white colour represents all incident radiation. The second positioning of the sensor pair is frequently done if this law is followed. The photodiode and the IR LED are placed next to each other in this manner. Since there is no direct line of communication between the transmitter and the receiver when the IR transmitter emits infrared, the discharged radiation should reflect back to the photodiode after reaching some post. The thing's outside is usually divided into two types: intelligent surface and non-intelligent surface. If the thing's outside is intellectual in nature, such as white or another light tone, the rest of the radiation would be

reflected back to arrive at the photodiode. Present flows within the photodiode depending on the intensity of the reflected radiation.

If the exterior of the item is non-intelligent in nature, such as gloomy or other flat tones, it retains the majority of the radiation episode as a result. Since there is no reflecting radiation, there is no radiation on the photodiode, and as a result, the obstruction of the photodiode remains stronger, preventing current from flowing. This model is essentially the same as having no object at all.

4.6 Bluetooth Module HC-05:

- It's used in a variety of applications, including remote headsets, game controllers, remote mice, remote consoles, and a variety of other shopper applications. •It has a range of up to 100 metres, depending on the transmitter and receiver, as well as the weather, regional, and metropolitan circumstances.
- It is an IEEE 802.15.1 standardised convention for constructing a remote Personal Area Network (PAN). It sends data over the air using recurrence bouncing spread spectrum (FHSS) radio technology.
- It communicates with devices using sequential correspondence. It communicates with the microcontroller through the sequential port (USART).
- The HC-05 is a Bluetooth module designed for remote communication. This module can be used as either an expert or a slave.

HC-05 module has two modes,

1. **Data mode:** Data transfer between devices.
2. **Command mode:** It makes use of AT instructions, which are used to adjust the HC-05's settings. The module sequential (USART) port is used to transmit these instructions.

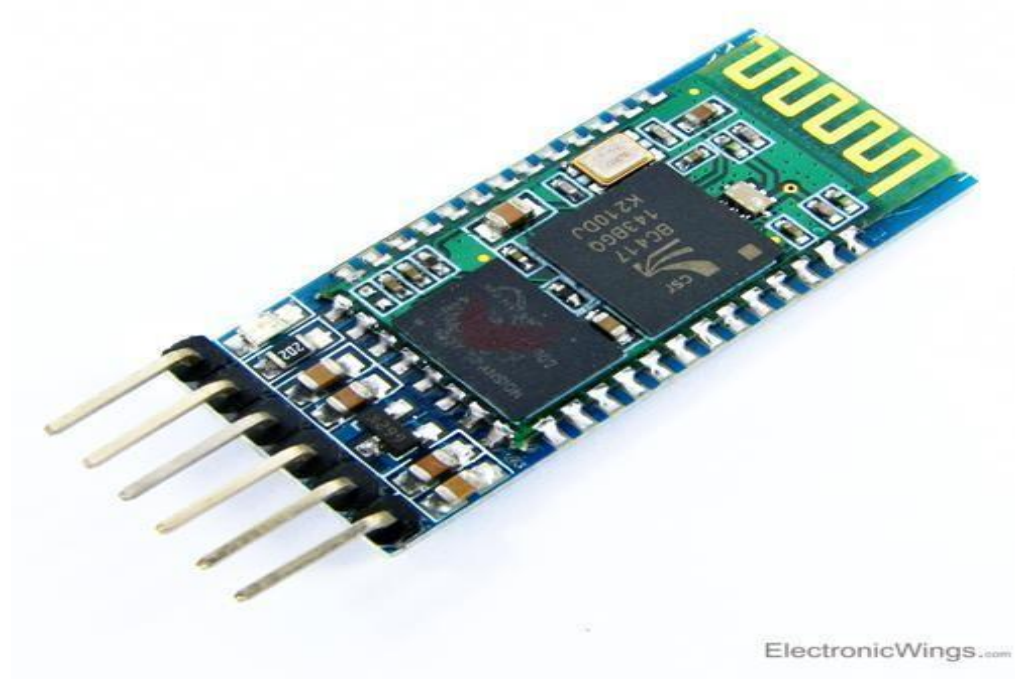


Fig 2.16: HC-05 Bluetooth Module

4.6.1 Pin Description:



Fig 2.17: pin description

It has 6 pins,

1. **Key/EN:** Bluetooth module AT orders mode is a common occurrence. This module can run in order mode if the Key/EN pin is set to big. In any case, it's in knowledge mode by default. In order mode, the HC-05's default baud rate is 38400bps, and in information mode, it's 9600bps.

2. **VCC:** Connect 5 V or 3.3 V to this Pin.
3. **GND:** Ground Pin of module.
4. **TXD:** Serial knowledge is communicated (remotely got information by Bluetooth module sent out sequentially on TXD pin)
5. **RXD:** The transmission of serial intelligence (remotely got information by Bluetooth module sent out sequentially on TXD pin)
6. **State:** It tells whether module weather it is connected or not.

4.6.2 Bluetooth communication between Devices:

To use the HC-05 Bluetooth module with a mobile phone, you'll need a Bluetooth terminal programme to transmit and receive data. In a different device store, you'll find Bluetooth terminal apps for Android and Windows. As an example, Send data from a Smartphone terminal to the HC-05 Bluetooth module, then view it on a PC serial terminal, and vice versa.

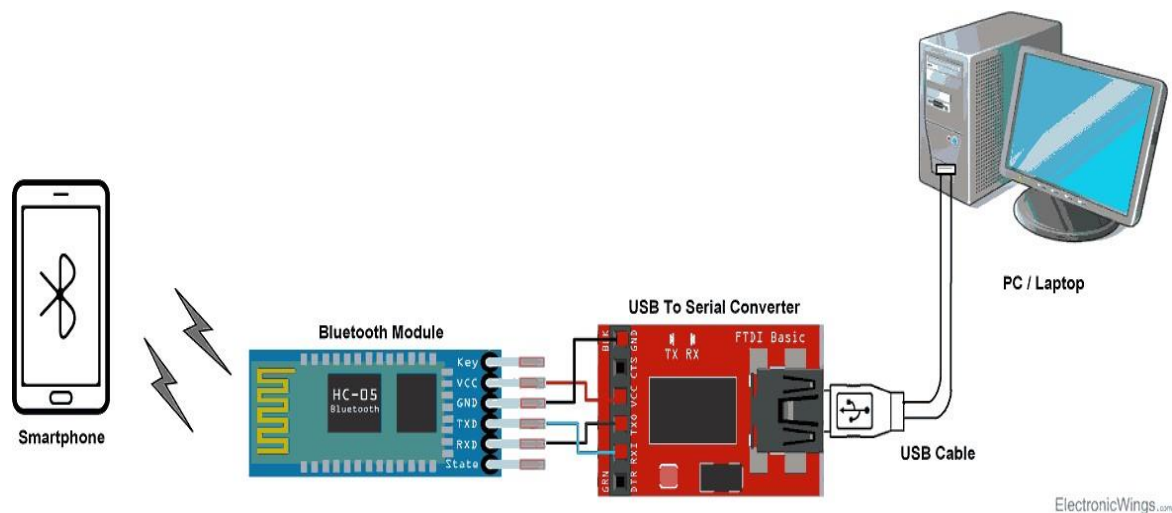


Fig 2.18: Bluetooth Module Serial Interface

As a result, when using a mobile phone with the HC-05 Bluetooth module, connect the HC-05 module to the PC using a sequential to USB adapter. We'd like to connect the HC-05 module with the smartphone for connectivity before creating communication between two Bluetooth devices.

4.6.3 Pair HC-05 and smartphone:

1. Use your phone to look for a new Bluetooth kit. A Bluetooth computer with the code "HC-05" can be found.
2. Click the associate/pair gadget option; the HC-05's default pin is 1234 or 0000. After you've combined two Bluetooth gadgets, open terminal programming (for

example, Tera term, Real term, and so on) in your PC and choose the port where the USB to sequential module is connected. Similarly, choose 9600 bps as the default baud rate.

- Open the Bluetooth terminal programme on your handset and connect it with the HC-05 combined gadget.
- It is simple to communicate; all we need to do is type into the Bluetooth terminal programme on our smartphone. Characters will be sent to the Bluetooth module HC-05 via a remote connection. As a result, the HC-05 will transmit it sequentially to the PC, which will appear on the terminal. We'll send data from a PC to a mobile phone in the same way.

4.6.4 Command Mode:

- When we choose to adjust the settings of the HC-05 Bluetooth module, such as the hidden word for association, the baud rate, the name of the Bluetooth device, and so on
- To do this, the HC-05 has AT orders.
- Connect the "Key" pin to High to use the HC-05 Bluetooth module in AT order mode (VCC).
- The HC-05's default baud rate in order mode is 38400bps.
- The following AT commands will, for the most part, adjust the Bluetooth module's settings.
- To transmit these instructions, we'll use a sequential to USB converter to connect the HC-05 Bluetooth module to the PC and communicate the commands via the PC's sequential terminal.

Command	Description	Response
AT	Checking communication	OK
AT+PSWD=XXXX	Set Password e.g. AT+PSWD=4567	OK
AT+NAME=XXXX	Set Bluetooth Device Name e.g. AT+NAME=MyHC-05	OK
AT+UART=Baud rate, stop bit, parity bit	Change Baud rate e.g. AT+UART=9600,1,0	OK
AT+VERSION?	Respond version no. of Bluetooth module	+Version: XX OK e.g. +Version: 2.0 20130107 OK
AT+ORGL	Send detail of setting done by manufacturer	Parameters: device type, module mode, serial parameter, pass key, etc.

4.7 POWER SUPPLY:

Almost all electronic devices in electronic circuits need a dc power source to function. The dc operating points (Q-points) for the passive and active electronic devices embedded into the system are determined using the dc power source. In most electronic systems, the dc power supply is linked to each and every point. It means that the only condition that applies to all or most phases of electronics is a source of dc electricity. For convenient low-power frameworks batteries could likewise be utilized, yet their working period is confined. Accordingly for while activity successive re-energizing or substitution of batteries become a lot costlier and complex. However, more often than not, gear is energised by an impact source, which is obtained by changing, amending, and filtering a quality modern or homegrown ac supply. (A typical dc power supply, also known as an unregulated force supply, is made up of a transformer, a rectifier, and a channel.) As seen in the diagram, a controlled power supply consists of a normal power supply and a voltage guiding device. The output of a typical force supply is directed to a voltage-controlling device, which produces a definite output.

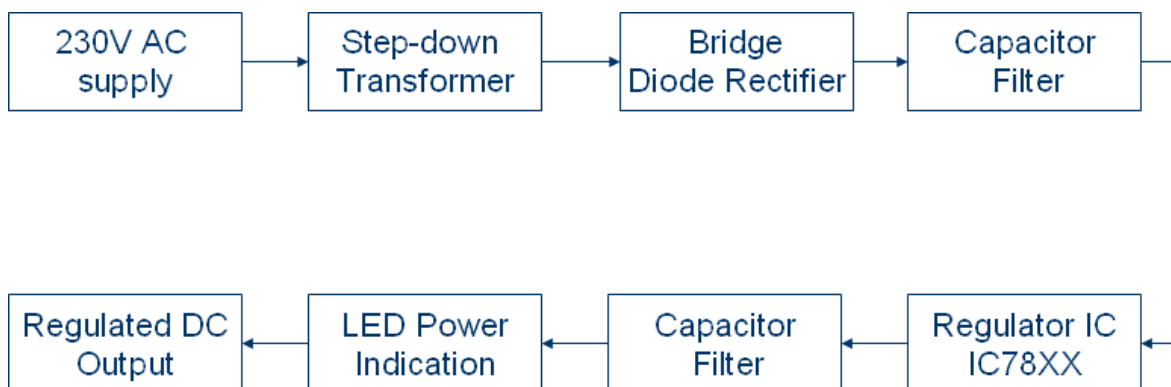


Fig 2.19: Block Diagram of RPS

Graph of Regulated Power Supply

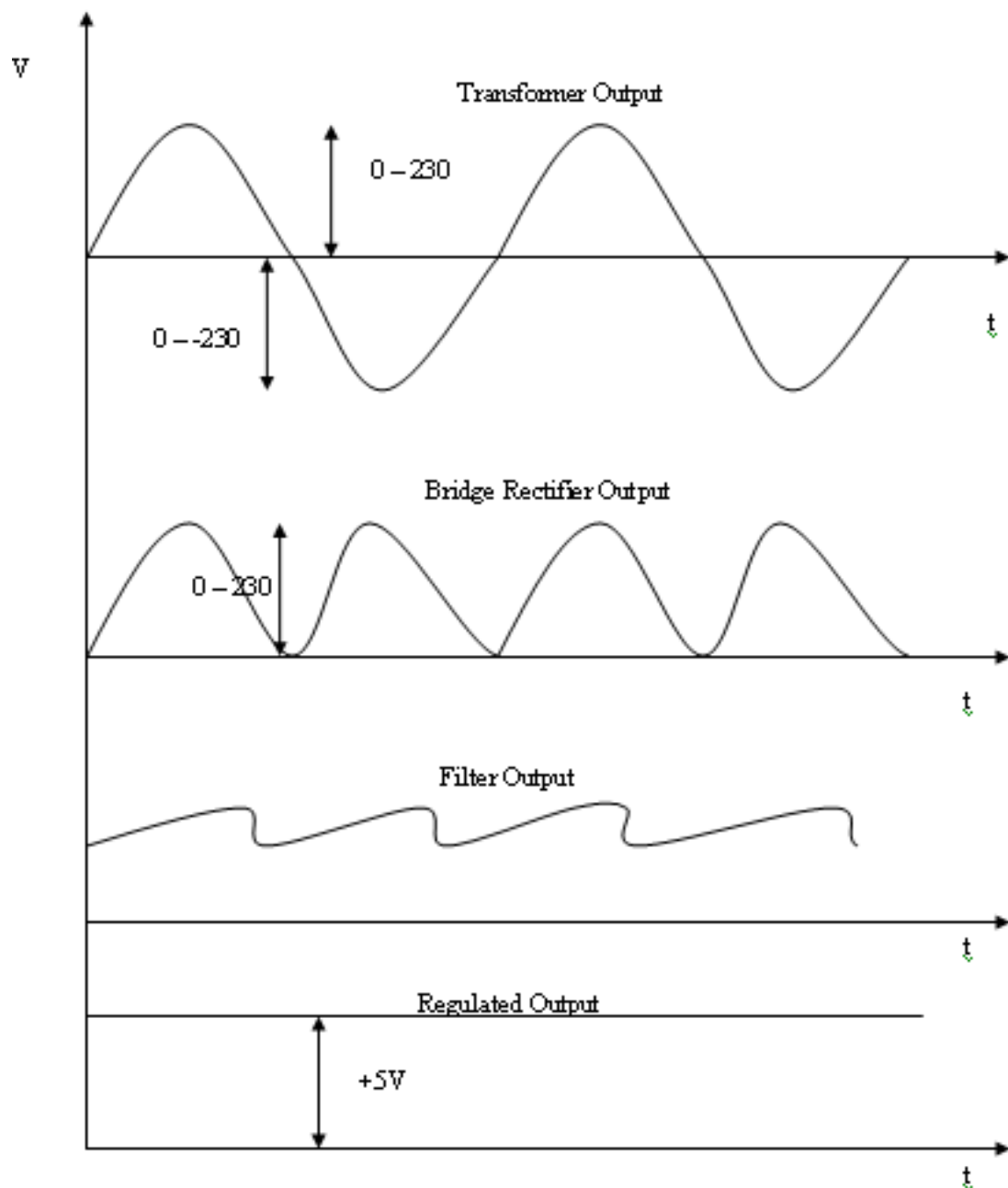


Fig 2.20: Output of RPS

SOFTWARE PROFILE

4.8 PROTEUS:

Proteus may be a circuit simulation AND virtual system modelling tool. The software combines blended mode SPICE circuit reenactment, energised components, and chip models for co-creation of full microcontroller-based plans. Proteus can also simulate the interaction between microcontroller programming and any basic or advanced devices that are connected to it. It imitates Input/Output ports, as well as clocks, USARTs, and all other peripherals found on each supported cpu.

4.9 ARDUINO IDE:

the original It's possible that the Arduino is a microcontroller board based on the ATmega328 (datasheet). It has 14 electrical input and output pins (six of which are commonly used as PWM outputs), six analogue inputs, a 16 MHz ceramic resonator, a USB connector, an impact jack, an ICSP header, and a push button. Its architectures have aids that help the microcontroller in any way possible. To use it, you must first attach it to a computer via USB or force it with an AC-to-DC connector or battery. It's available in two distinct forms: Arduino Uno and Genuino Uno, both of which can be pictured. The variations are visible in relation to the location. The Uno differs from its predecessors in that it does not make use of the FTDI USB-to-chronic driver chip. In Italian, "uno" means "one," and it was given the name to signal the imminent arrival of Arduino 1.0. Inside the forward venture, the Uno and adaptation 1.0 are the reference renditions of Arduino. Uno USB is the most current Arduino sheet in the series, and is thus the Arduino stage's reference model. A content manager, a message field, a book support, a toolbar with catches for routine assignments, and a progression of menus for writing code make up the Arduino Integrated Development Environment, or Arduino Software (IDE). This software connects to Arduino and Genuino devices to move data and communicate with them. Charts are projects created with the Arduino Software (IDE). These sketches are created in the content tool and stored as an expansion.ino file. Cutting/sticking and looking/evolving text are highlighted by the proofreader. The message area responds to saving and selling, as well as displaying errors. The help display text produced by the Arduino Software (IDE), which includes complete error

messages and other information. The built board and gui can be seen in the window's bottom right corner. You can use the toolbar buttons to search and switch programmes, create, open, and save drawings, and access the chronic screen.

4.10 REINFORCEMENT LEARNING:

Reinforcement Learning (RL) is a form of learning that is based on positive reinforcement. When it comes to tossing things to a target, we don't give it much thought; we just chuck. The truth is that our brain is wired in such a way that when we throw, we don't have to think or calculate. However, upon closer inspection, we discovered that throwing is a very difficult and time-consuming activity. Many equations and considerations are involved, as well as angular arm motions. These stuff, as a person's, are very easy, and we often overlook their wisdom. When it comes to throwing, we don't pay attention to what we're holding; instead, we focus on the target. To strike the mark, the brain approximates the force to use, the angular motion of the fist, and hence the timing to release the thing. Implementing this on a robotic arm is a difficult process. The device should be self-contained, taking goal data from the cameras and processing it in order to map all of the necessary variables in real time. Determining and predicting the direction on which the object will fly is also a crucial job, since if the thing is freed from the hold, there is no way to manage it in the air. For doing this job creatively, we suggest reinforcement learning. The framework will teach itself to toss and improve its precision in order to strike a target. In general, precise preparation of the details from the camera to the world measure is critical. For this, we suggest starting with a few subjective variables and keeping track of the outcomes of each effort. Tossing for arbitrary values at first, what will either climb above the goal or will essentially miss the mark. just in case the thing goes above the limit set it as F_{max} (Maximum required value to hit the target). When the thing drops before reaching the target in certain iterations, set it to F_{min} (Min necessary value to hit the target). Now that you have F_{max} and F_{min} , use binary search to find an optimal mapping scaling factor. Getting the correct value will take multiple iterations. Change the goal spot until you've had this ideal element of scaling and mapping, and the arm

can throw the thing and catch the target with the first arrow. During this process, the machine learns and strengthens itself by reinforcement learning. This makes the structure more complex and allows for the addition of different environments. This can be used to sort items for commercial or domestic purposes, as well as to play games like Dart. Playing darts against the robotic arm would be a lot of fun.

Chapter – 5

5.0 Results and Discussion, Performance Analysis

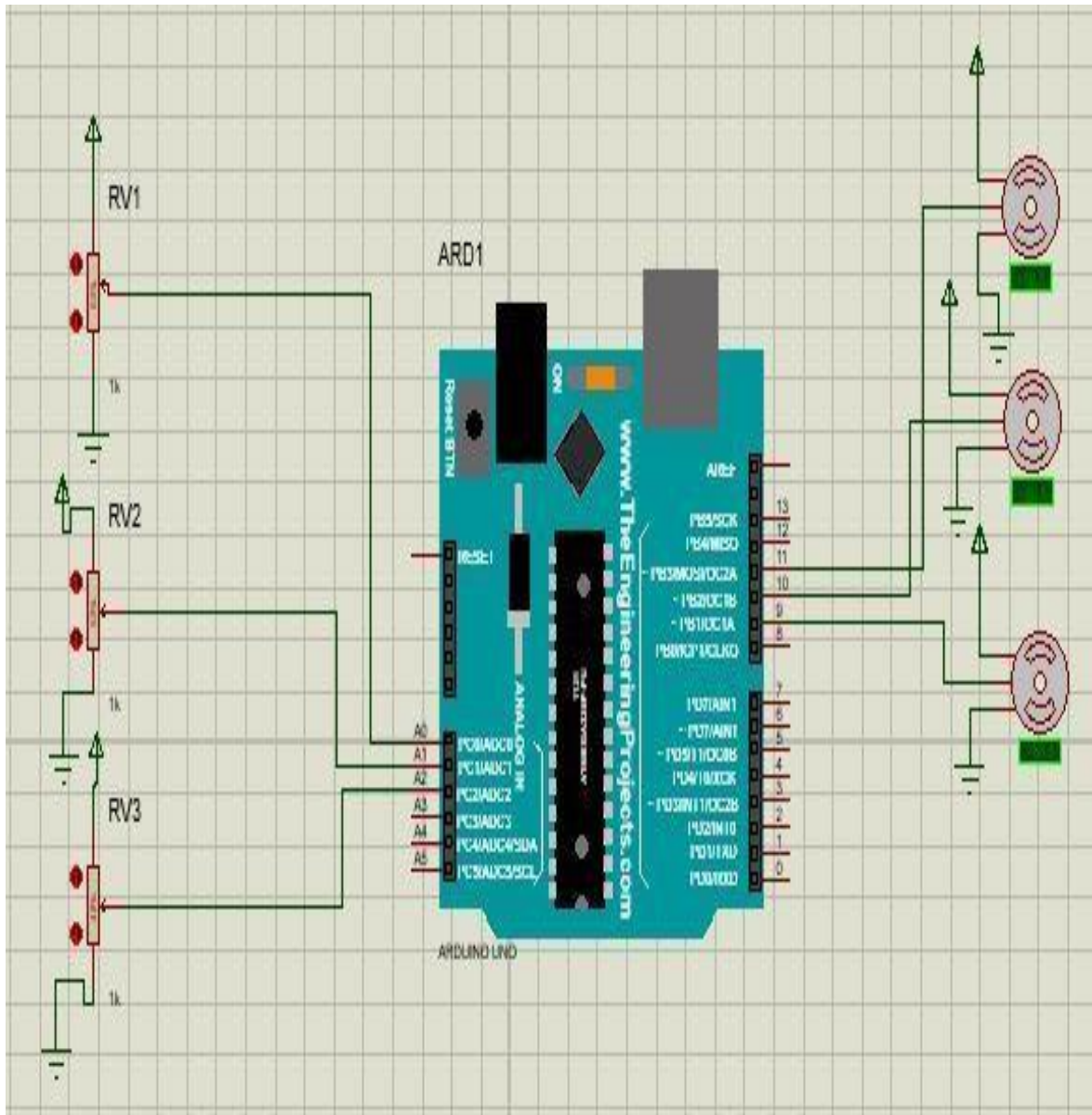
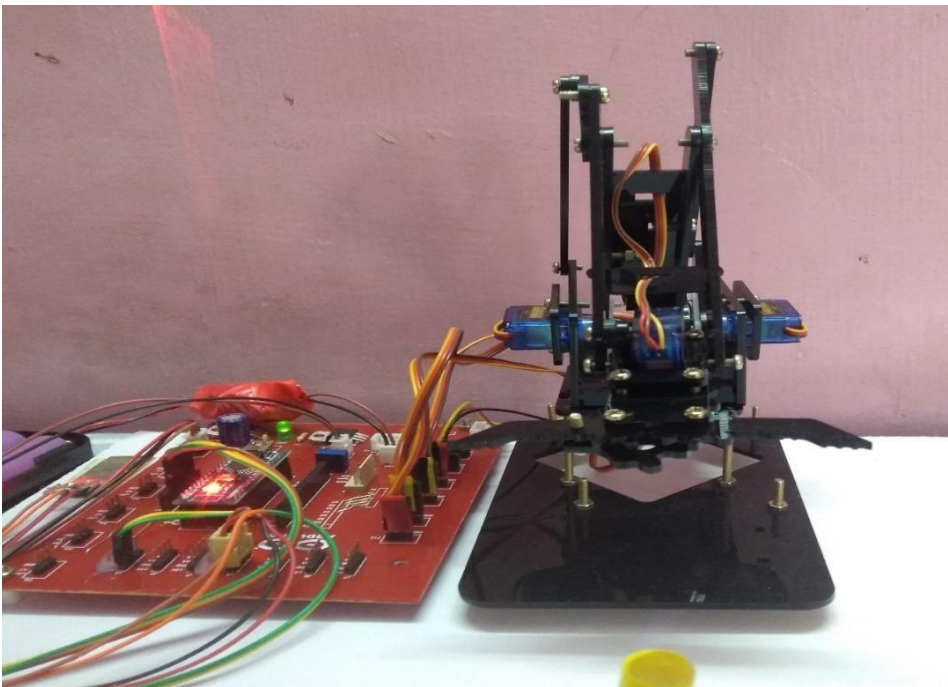
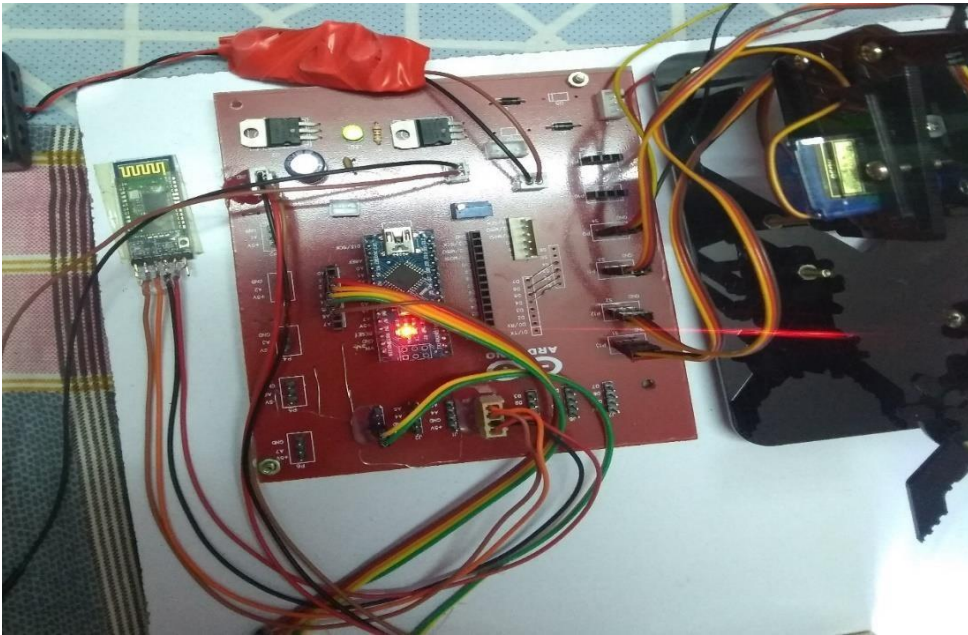
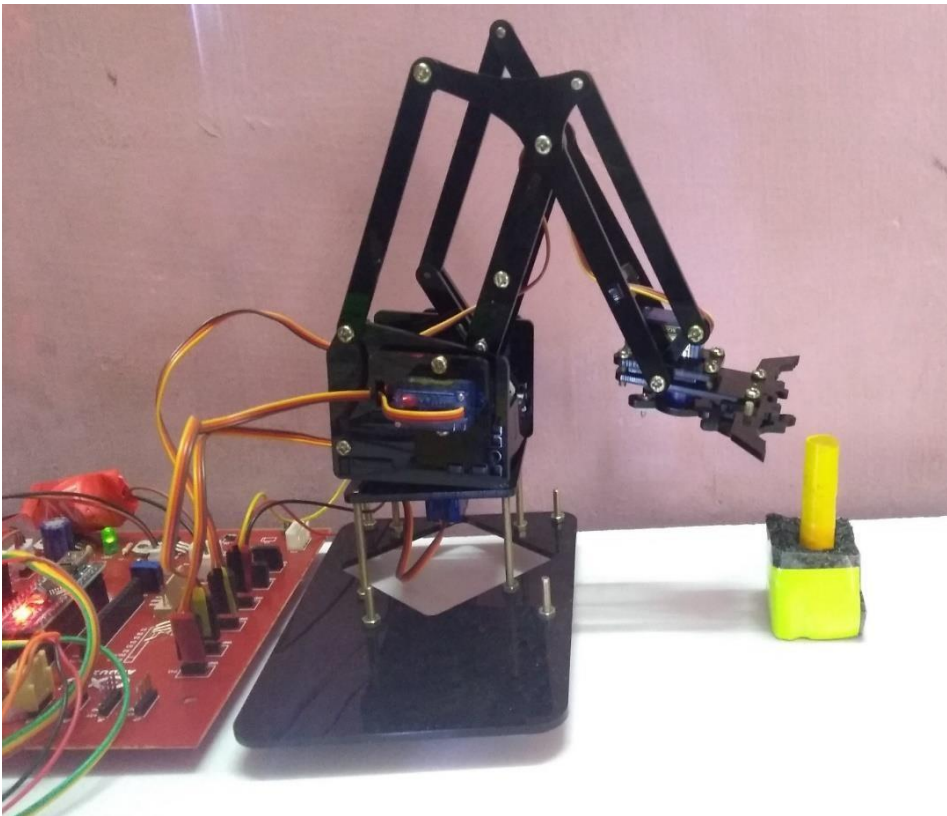
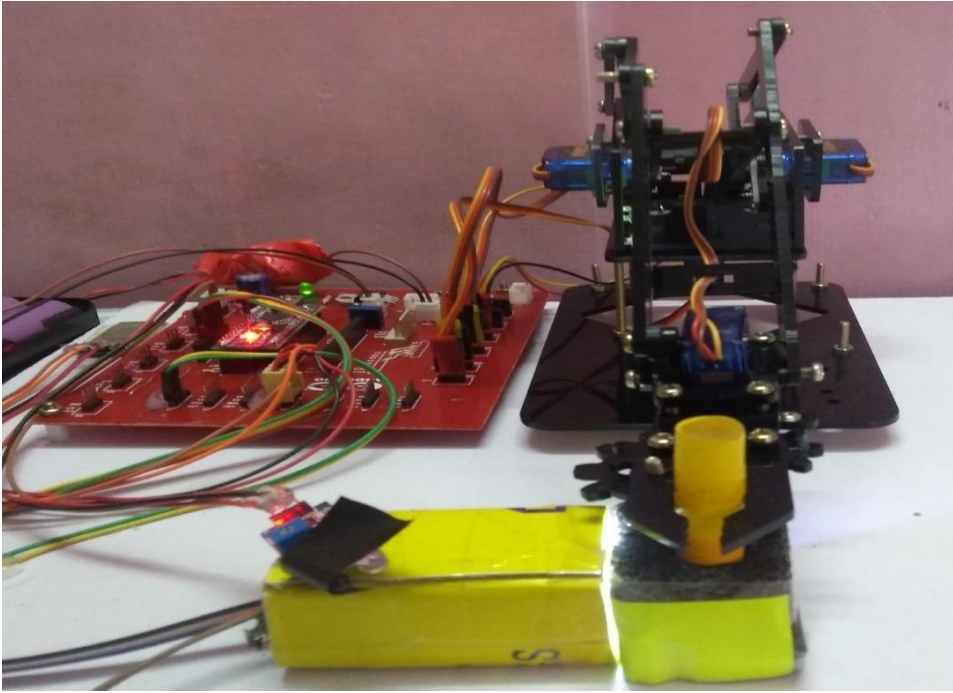


Fig 3.1: simulation result

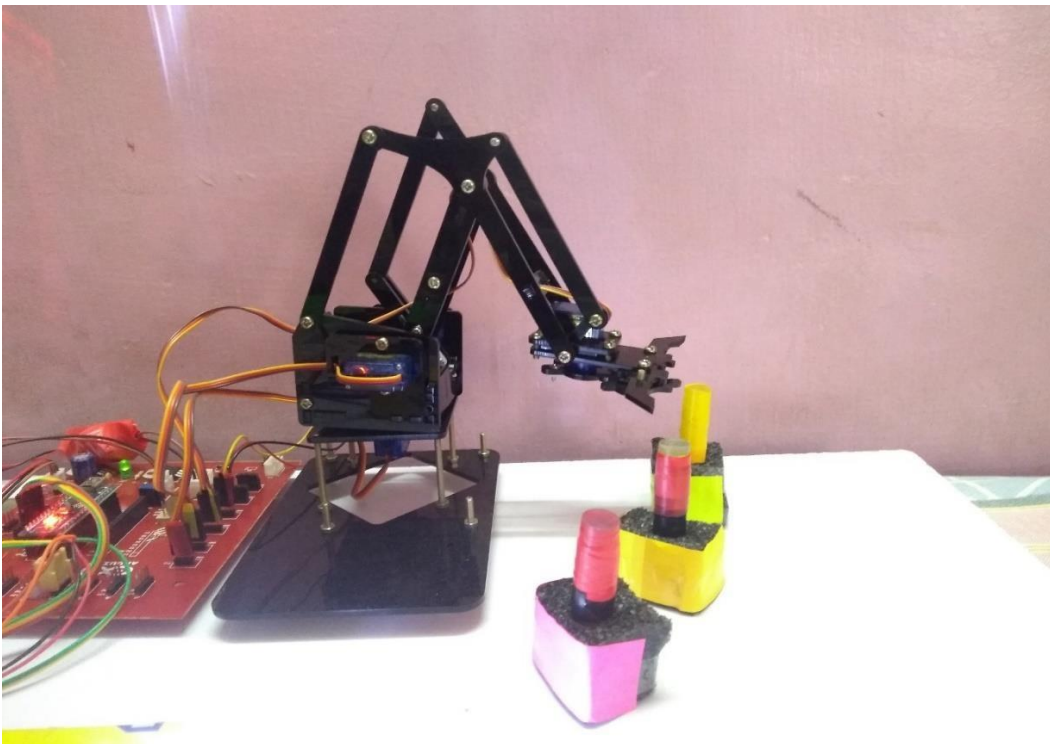
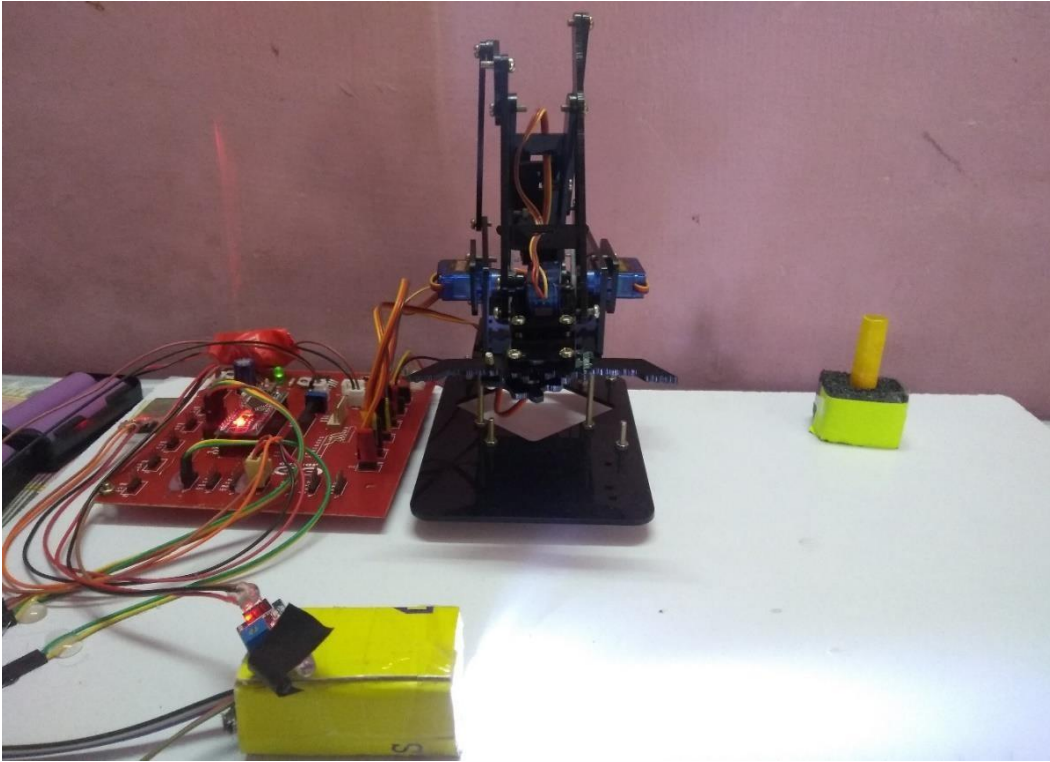
5.1 Final result:



- After power on every device is powered and it searches for the object
- A colour recognition procedure is carried out. The tcs320 colour sensor module employs a high-quality light sensor that allows us to detect any colour by combining red, green, and yellow light.



- When the object is detected (green) position is decided after which the 4DOF robotic arm with similar function of a human arm picks and places the object to its corresponding position (position1 green)



Bluetooth Terminal HC-05

ASCII



Connected to gesture

[Mar 2, 2021 9:43:57 PM] ASCII:

R= 12G= 45B= 7BLUE:6

R= 17G= 19B= 7RED.....

RED:5

R= 14G= 26B= 8Black:2

- After placing the object the arm return back to its home position and when the second object is detected (yellow) it places it on position 2 followed by the third object (red) in position 3
- And the live update of the system is obtained.

Chapter – 6

6.0 Summary and Conclusions

6.1 FUTURE SCOPE:

Robotic Arms has a wide production spectrum. In the not-too-distant future, weapons will be capable of doing any job that humans do, and in a much better manner. The only limit to its possible applications is one's imagination. It is frequently a lifesaver for handicapped individuals who have been paralysed or have lost their hands due to an injury. The arm is often taught to focus on a person's order and execute the duty. It is also possible to use a gesture-controlled device. Wearable sensors are sometimes used to transmit commands and monitor arm motions. BCI (Brain Computer Interface) is a rapidly growing area of study. BCIs are often used to collect impulses from the brain and activate the limb. The machine will add in the same way as a human arm can. Such artificial arms enable a person who has lost his hand in an accident to regain his life as before. Robotic weapons are adaptable and can be used in a variety of ways.

6.2 CONCLUSION:

Our thesis on early robotic arm research and development is presented in this project. We would go into the simple mathematical model of weapons that can be used to execute the arm. Despite years of study, robotic arm implementations are limited to sectors and are mainly found in industrial units to increase productivity. These weapons are highly advanced and capable of making extremely precise gestures. Robotic weapons also have a wide range of general-purpose and domestic uses that have yet to be fully investigated. The biggest limitation on robotic arms is cost, and lowering it is a difficult task. The construction of these devices necessitates the use of high-torque, high-precision servos. These are the most costly materials which are the ones that allow the arm to move. Finding solutions to these motors in order to reduce costs is a must. And, the substance used by the body should be light and long-lasting. The motors' performance and torque can be improved by the light weight body. The materials and pieces come in a variety of shapes and sizes, depending on the application. It's a difficult task to get these devices to the point that they can be sold as a commodity for general-purpose use. If these issues are overcome, robotic arms will be visible anywhere as a "helping hand" in no time.

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DOI: 10.1109/ICECOS.2017.8167128
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2019 International Conference on Robotics, Electrical and Signal Processing Techniques (ICREST) DOI: 10.1109/ICREST.2019.8644167

plagiarism report

by KAVIN kishore

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ABSTRACT

All sectors are being industrialised in the age of robotics and automation in order to achieve exponential growth and advancement. We present a robotic arm with a clever approach to incorporate sorting of items based on colour using a Machine Learning Algorithm in this project. The robotic arm can rotate like human hands to its predefined angles. The color detection is done by color sensor. Robotic arm is widely used and it is a preferred electromechanical machine for many applications it has similar functions of a human arm robotic arm functioning is base on sensors which pick and place object Here, We built a robotic arm that sorts small objects before picking and placing them in various boxes, and all data is modified via Bluetooth module. The device is kept up to date in real time thanks to the Bluetooth module that has been mounted. A microcontroller-based mechanism controls the robotic arm's base, elbow, wrist, and grip, as well as servo motors in the base, elbow, wrist, and grip.

CONTENTS		
CHAPTER NO	TITLE	PAGE NO
	ABSTRACT	ii
	LIST OF FIGURES	ii
1	INTRODUCTION	1
	1.1 Introduction to robots	1
	1.2 Robotic Arm	1
	1.3 Overview	2
	1.4 Objective	2
2	Literature survey	3
	summary	4
3	AIM AND SCOPE OF PRESENT INVESTIGATION	5
	3.1 Block diagram of the proposed work	6
	3.2 What are robots	6
	3.3 Bluetooth low energy	6
	3.4 Bluetooth low energy architecture	6
	3.5 Robots	8
	3.6 Applications	8
	3.7 Industrial robots	8
	3.8 Domestic and household robots	9
	3.9 Medical robots	9
	3.10 Top six uses for robotics in field of medicine today	9
	3.11 Algorithm	10
	3.12 Circuit diagram	11
4	EXPERIMENTAL OR MATERIALS AND METHODS	12
	ALGORITHMS USED	
	4.1 Structure member	12
	4.1.1 Basic design	12
	4.1.2 Improved stability	12
	4.2 Electronic components	12

4.2.1 AVR microcontroller	12
4.3 Arduino	13
4.3.1 Arduino nano	14
4.3.2 Specifications	14
4.3.3 Reason for using Arduino	15
4.3.4 Arduino kit	16
4.3.5 Analog to digital converter module	18
4.3.6 Servo motor	19
4.3.7 Servo motor SG90	22
4.4 TCS 320 color sensor	22
4.5 IR sensor	23
4.5.1 IR sensor board	23
4.5.2 IR Transmitter	25
4.5.3 Obstacle sensing circuit IR sensor circuit	26
4.5.4 Distinguish between black and white colors	27
4.6 Bluetooth module HC-05	28
4.6.1 Pin description	29
4.6.2 Bluetooth description between devices	30
4.6.3 Pair HC-05 and smartphone	30
4.6.4 Command mode	31
4.7 Power supply	33
4.8 Proteus	35
4.9 Arduino IDE	35
4.10 Reinforcement learning	36
5 RESULTS AND DISCUSSION ,PERFORMANCE ANALYSIS	37
5.1 Final result	38
6 SUMMARY AND CONCLUSION	41
6.1 Future scope	41
6.2 Conclusion	41

LIST OF FIGURES

FIGURE NO	TITLE	PAGE NO
1.1	Block diagram	6
1.2	Bluetooth low energy architecture	8
1.3	Algorithm for robotic arm	10
1.4	Circuit diagram	11
2.1	Nano front view	15
2.2	Nano rear view	15
2.3	Arduino kit	16
2.4	Arduino architecture	17
2.5	Working of servo	20
2.6	Inside a servo motor module	20
2.7	Variable pulse width control servo position	21
2.8	Servo motor SG90	22
2.9	Pulse wave modulation	22
2.10	Functional block diagram	23
2.11	TCS320 color sensor	23
2.12	IR Sensor	24
2.13	Infrared LED	25
2.14	Schematic diagram for IR transmitter	25
2.15	IR Sensing circuit	26
2.16	HC-05 Bluetooth module	29
2.17	Pin description	29
2.18	Bluetooth module serial interface	30
2.19	Block diagram of RPS	33
2.20	Output of RPS	34
3.1	Simulation result	37

CHAPTER 1

INTRODUCTION

1.2 INTRODUCTION TO ROBOTS:

The word robot refers to both real robots and automated machine agents, although the latter are commonly referred to as bots. There is no agreement about which machines count as robots, but analysts and the general public agree that robots maintain any or more of the following capabilities or roles.

1.3 ROBOTIC ARM:

A robotic arm is a form of mechanical arm that is normally programable and has capabilities similar to a human arm; the arm may be the entire instrument or it may be used for a more unpredictable robot. Joints bind the connections of such a controller, allowing rotational movement (for example, in a verbalised robot) or translational (direct) dislodging.

NASA uses autonomous weapons to transport massive objects into space. The "Canadarm" robot arm of the space bus first flew on the bus' second mission in 1981. The larger Canadarm2 is housed on the International Space Station. For certain positions, the space transport has used its arm. It may very well be used to launch or recover satellites. The arm, for example, has been used to snare the Hubble Space Telescope on five separate fix flights. To help construct the station, the bus and space station weapons collaborate. The station's mechanical weapons have been used to transfer new components into operation. During spacewalks, the weapons will also be used to pass space travellers across the station. The arm of the space station will travel around the station to reach different parts. Like an inchworm, it runs along the outside of the station, connecting at either end. It also has a Dextre, an artificial "hand" that can perform smaller tasks. These controlled weapons can be controlled by a space explorer or someone in Mission Control. To pass the arm around, the space traveller uses regulators that look like joysticks from video games.

1.3 OVERVIEW:

This project is the secret to much of the precise work that humans can't perform repeatedly, and it's where a robotic arm, or as we'll call it, a pick-and-place robot, comes into play. Mechanical technology is the branch of engineering, electrical engineering, and registration that deals with the planning, production, operation, and use of robots, as well as computer systems for controlling, analysing, and storing data. A robotic arm may be a mechanical arm that is naturally programmable and has similar capacities to an individual's arm; the arm could also be the size of the device or a part of a more complex robot. Joints bind the links of such a controller, allowing rotational movement (for example, in an explained robot) or translational (direct) elimination.

1.4 OBJECTIVE:

- Colour based object sorting robotic arm using machine learning algorithm
- Designed a 4 degrees of freedom robotic arm(4DOF) and implemented machine learning algorithm in hardware
- With the help of Bluetooth low energy live update of the system is obtained

CHAPTER-2 LITERATURE SURVEY

2.1 LITERATURE SUMMARY:

Topic1: Design of fruit segregation and packaging machine

Reference:[2020 International Conference Computational Performance Evaluation (ComPE) Jul 2-4, 2020DOI:10.1109/comPE493225.2020.9199986]

Overview:

Automation, as the fundamental property in the agricultural field, enhances and strengthens the consistency, breadth, and productivity of manufacturing products. The rate of assessment has improved as a result of improved product sorting. Since sorting is one of the most significant market problems, a reliable sorting system was needed so that the items could be packaged automatically. Preprocessing, thresholding, segmentation, extraction, labelling, and detection are all properties used in this operation.

Topic2: Genetic algorithm based pick and place sequence optimization for a color and size sorting delta robot

Reference:[2020 4TH June international Conference on control automation and robotics DOI:10.1109/ICCAR49639.2020.9108045]

Overview: In industry, delta robots are used for light-weight material processing and sorting. A sequence optimising algorithm for a colour and size sorting delta robot is presented in this article. It finds the optimum path within the task space to perform a industry emulated scenario an open cv python program was developed to sort objects consistent with their color and sizes the static positional coordinates of the objects within the robot workspace are obtained using the program

Topic3: Low-cost vision space for pick and place application using camera and ABB industrial robots

Reference:[IEEE-49239 Approved on 1-3 july 2020
DOI:10.1109/ICCCNT49239.2020.9225522]

Overview: This paper introduces and discusses a vision-based pick and place robot that uses an ABB IRB 140 industrial robot and a web camera. The robot, which is sent directly from the company, lacks the intelligence to sense colour. This project employs a colour algorithm created in Matlab 2013 with the help of the image processing and computer vision toolbox.

Topic4: Machine Learning and its Emergence in the Modern World and its Contribution to Artificial Intelligence

Reference: [2020 International conference for Emerging technology (INCET) jun 5-7,2020]

Overview: Machine learning is described as the empirical analysis of a variety of algorithms and statistics, as well as models that can be used to generate or perform specific tasks. Because of the trends, these functions are often dependent on the dependability of the Interface. Machine learning, which is also known as a subclass of AI, allows the system to render or execute a variety of tasks without the need for any human intervention. This mechanism is also synonymous with automated success and self-learning since it is often used to detect multiple faults within an inbuilt system or programme and take the requisite measures to debug and run diagnostics in order to minimise errors to the greatest extent possible.

Topic5: Object color recognition and sorting robot based on OpenCV and machine visionReference:.[Jan 20-22 2020 IEEE 11th International Conference]

Overview: Intelligent recognition technology is a critical component of new intelligent handling systems and a significant research topic in AI. A quest scheme of "OpenCV-based colour recognition capture robot" is proposed for this project. Image identification, navigation technology, and manipulator instruments are used to sort and move targets of various colour characteristics, and machine vision is used to incorporate the three-axis truss manipulator framework.

DRAWBACKS AND MY METHODOLOGY:

Error rates are high on previous methodology which are upto upto 15 percentage to overcome this problem we have implemented ml algorithm so we can achieve reduction in error rate upto 2 percent and we have used reinforcement learning method Reinforcement Learning is thrown. When we, as humans, imagine tossing something at a target, we don't give it much thought; we simply chuck. The irony is that our brain is wired in such a way that when we throw, we don't have to think or calculate anything.

CHAPTER-3

AIM AND SCOPE OF PRESENT INVESTIGATION

The fundamental focal point of this venture was to plan and build up the component for mechanical arm for lifting. The automatic arm was designed with four stages of capability and adapted to perform a precise light material lifting task to assist the production line of every industry. The components of the mechanical arm are manufactured using a laser cutting strategy in this project. This resulted in more precise calculations as well as significant time and expense savings during the manufacturing process. The automatic arm is equipped with four servo engines that attach the components and allow the arm to move. Steel outlines that have spaces that suit the servo engine connect the automated arm joints. The controller has a sum of 4 level of opportunity excluding the gripper. It has five kind of revolution which is base turn, shoulder pivot, elbow pivot, wrist pivot and gripper revolution. The servo engines are appended to each joint dependent on the measure of force it can deliver. Arduino, an open-source PC equipment and programming is applied to control the mechanical arm by driving servo engines to be able to change the position. In this undertaking we gives a 4DOF mechanical arm a shrewd way to deal with carry out arranging of items based on shading utilizing Machine Learning Algorithm. The automated arm can turn like human hands to its predefined points. In a mechanics context, four degrees of opportunity are clear, characterised modes in which a mechanical device or structure may travel. The total number of free relocations or pieces of travel is equal to the number of degrees of opportunity. The word is commonly used to describe a robot's ability to drive. The shading discovery is finished by shading sensor and IR sensor. Shading based item arranging mechanical arm utilizing AI calculation. we Designed a 4 levels of opportunity automated arm (4DOF) and to diminish the blunder rate upto 1 percent we have executed AI calculation in equipment. With the assistance of Bluetooth low energy live update of the system is obtained

3.1.1 BLOCK DIAGRAM OF THE PROPOSED WORK



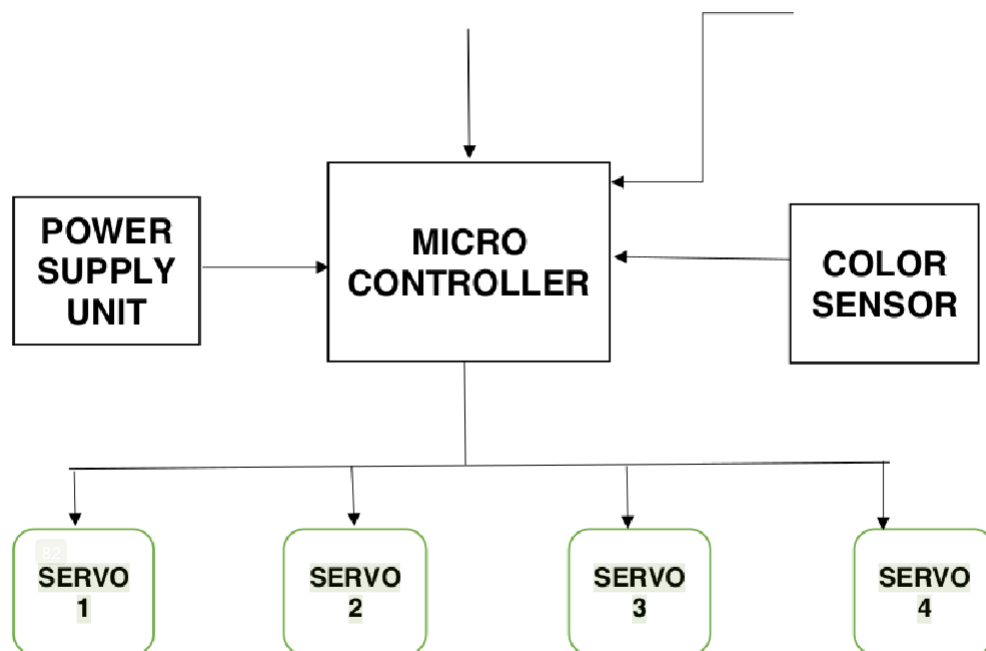


Fig: 1.1 block diagram

Robotics is a confluence between engineering and science that includes engineering, computation, and robotics. It is no longer an emerging discipline because it has developed too far in the past ten years and is approaching its apex. It's an ever growing field and lots of avenues have opened in recent past. The promise of robotics is straightforward to explain but hard for the mind to understand. A robot might be a mechanical or virtual shrewd specialist which will perform errands consequently or with direction, commonly by far off. By and by a robot is ordinarily an electromechanical machine that is guided by PC and electronic programming. Robots hold the promise of moving and reworking materials with an equivalent ease as a computer virus transforms data. But the grey spot remains wide when it involves Research awareness within the field of Robotics and Automation. Sooner or later Robotics and automation will find its application in every facet of human life. The advancement in technology would bring each day of robots omnipresence. They're going to soon sneak everywhere from gadgets to apparels and to our very own bodies. Hence it's the responsibility of engineering community to disseminate the knowledge about the longer term scope and application of Robotics.

3.2 What are Robots?

The word "robot" comes from the Czech word "robota," which means "forced labour." Nobody has ever offered a definitive description of what a robot is, despite the fact that any of these meanings roughly translates to the same

thing, to make life easier. "Robot may be a combination of electronics, mechanics and programming which senses it's surrounding through its sensors processes the sensor information and does something in response". Turning on an LED, pivoting a wheel, moving an arm, lifting a caution, and so on are all examples of velocity or control reactions. Robotics is a field of computing and engineering that deals with robot design, development, application, and service. It has uses in computing, physics, engineering, security, and even a variety of household products. Embedded systems, such as portable music players and mobile phones, have a controller built in to execute basic tasks.

3.3 Bluetooth Low Energy (BLE): It is a low-power wireless system that allows computers to communicate with one another. BLE uses the 2.4 GHz ISM (Industrial, Scientific, which Medical) band and is aimed at devices that need less electricity and can run on batteries for months or even years.

3.4 Bluetooth Low Energy Architecture: Bluetooth began as a tool for replacing short-distance cables. For example, in devices like a mouse, keyboard, or a PC communicating with a personal digital assistant (PDA) that were common in the late 1990s and early 2000s, to swap wires in devices like a mouse, keyboard, or a PC communicating with a PDA. Ericsson launched the first supported version of Bluetooth in 1994. King Harald "Bluetooth" Gormsson of Denmark is credited with bringing together war forces in the tenth century CE.

- **Physical layer:** The physical layer (PHY) refers to the real radio that is used for communication and data regulation/demodulation. It operates within the ISM band (2.4 GHz range).

- **The link layer:** is the layer that communicates with the Physical Layer (Phone) and instructs the higher levels about how to interact with the radio (via a go-between layer called the HCI layer, which we'll discuss shortly). It's in charge of coping with the radio's state, as well as clinging to the Bluetooth Low Energy information, since the situation necessitates it.

- **Direct Test Mode:** the point of this mode is to check the activity of the radio at the actual level, (for example, transmission power, recipient affectability, and so on)

- **The Host Controller Interface (HCI)** The host layer is a basic convention defined by Bluetooth that enables the Host layer to communicate with the Controller layer. These layers could be on separate circuits, or they could be on the same chip.

The Logical Connection Control and Adaptation Protocol (L2CAP) layer serves as a multiplexing protocol. It collects a variety of conventions from the upper layers and stores them in regular BLE packets that are transferred down to the layers underneath it.

Bluetooth Low Energy Architecture

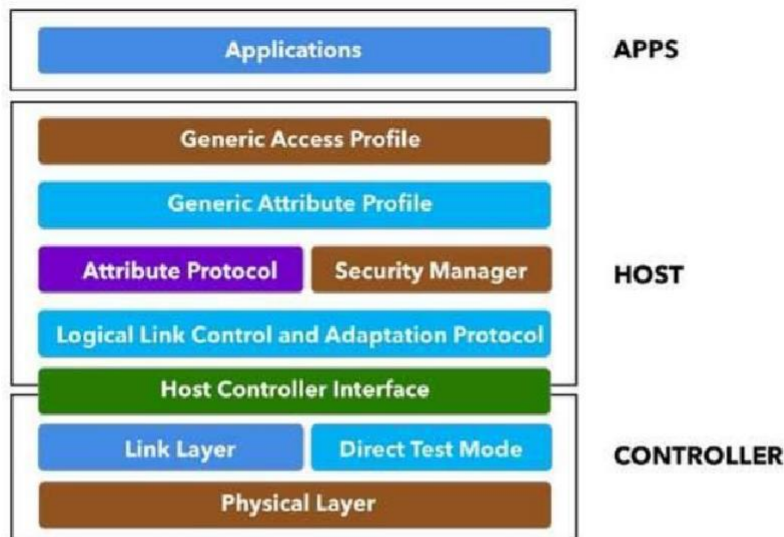


Fig1.2:Bluetooth low energy architecture

3.5 Robots:

Robots are hypothetically extraordinary in that they're furnished with sensors to see their current circumstance and actuators to perform specific assignments and may take insightful choices. Despite the fact that robots and inserted frameworks have all the earmarks of being two limits of designing world, the hole between them is diminishing. We definitely realize that clothes washers can detect soil in materials and takes savvy choices. Forced air systems can detect outside temperature and change interior temperature . These are smart installed frameworks worked inside another greater framework which sees it climate through its sensors and makes remedial moves, in this manner controlling the bigger framework

3.6 Applications:

Robots are now conducting a wide range of tasks in a variety of areas, and the number of tasks assigned to robots is increasing logically. The least complicated as a result of dividing robots into types could be a parcel by their use.

3.7 Industrial robots: In an industrialised assembly setting, modern robotics come into action. Typically, they are articulated weapons designed for tasks such as material handling, painting, welding, and other similar tasks.

3.8 Domestic or household robots:

Various pinion wheels are used in robots that are used at home, such as mechanical pool cleaners, automatic sweepers, mechanical vacuum cleaners, mechanical sewage cleaners, and other robots that can perform various family errands.

3.9 Medical robots:

Existing innovations are being included better approaches to smooth out the effectiveness of medical care activities. Subsequently, a sizable number of robots are being developed to assist in those roles within the healthcare setting. Careful robotics and rehabilitation robots are among the robots that serve in human therapy. In addition, the market for assistive and rehabilitation robotic systems is increasingly expanding. Robots that assist patients in rehabilitating from medical illnesses such as strokes, empathic robots that assist in the treatment of elderly or physically/mentally ill people, and mechanical robots that combat a variety of repetitive tasks, such as sanitising rooms and sound system representation, are among them, along with extended reality.

3.10 top six uses for robots in the field of medicine today:

1. Telepresence: Doctors use robotics to examine and treat patients in rural or remote areas, allowing them to "telepresence" within the hospital. Experts are commonly available to respond to questions and direct care from remote locations through the robot; key features of these mechanical devices include route capability within the (ER) and confounded cameras for the actual evaluation.

2. Surgical Assistants: These remote-controlled robots assist experts in completing tasks in a minimally invasive manner. "The ability to control a highly advanced mechanical arm using working controls located at a workstation outside of the OR is a sign of careful robots," says one expert. "Additional applications for these careful associate robots are constantly being created, as further developed 3DHD technology gives specialists the spatial references required for extremely complex medical procedures, including more implementations

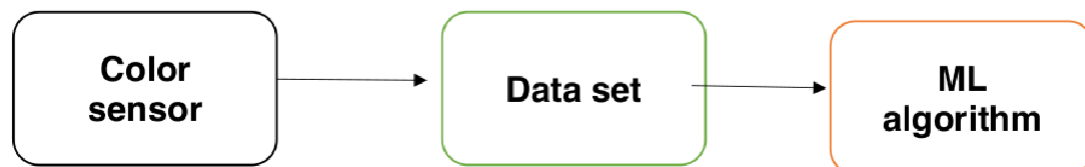
3. Rehabilitation: These play an important role in the recovery of people with disabilities, such as increased mobility, resilience, coordination, and personal fulfilment. These robots are often designed to adjust to each patient's situation when they recover from strokes, traumatic brain or medulla spinalis disorders, or neurobehavioral or neuromuscular diseases such as MS. Balance, driving, and other motor skills can all be improved by playing a video game with therapy robots.

4. Medical: in the medical sector These robots provide supplies, medications, and meals to patients and nurses, facilitating communication with doctors, emergency clinic staff members, and patients. "Most of those robots have deeply dedicated capacities for self navigation in the force," ManojSahi, a pursuit specialist with Tractica, a business insight company that focuses on creativity, says. "However, there is a need for highly advanced and realistic indoor path systems that support sensor combination field advancement to improve the navigational abilities of transportation robots."

5. Sanitation: With the ascent in anti-infection safe microorganisms and flare-ups of lethal diseases like Ebola, more medical services offices are utilizing robots to wash and clean surfaces. "At present, the main techniques utilized for sterilization are UV light and peroxide fumes," says Sahi. "These robots can clean a space of any microbes and infections in no time."

Robotic Arms has a wide production spectrum. In the not-too-distant future, weapons will be capable of doing any job that humans do, and in a much better manner. The only limit to its possible applications is one's imagination. It is frequently a lifesaver for handicapped individuals who have been paralysed or have lost their hands due to an injury. The arm is often taught to focus on a person's order and execute the duty. It is also possible to use a gesture-controlled device. Wearable sensors are sometimes used to transmit commands and monitor arm motions. BCI (Brain Computer Interface) is a rapidly growing area of study. BCIs are often used to collect impulses from the brain and activate the limb. The machine will add in the same way as a human arm can. Such artificial arms enable a person who has lost his hand in an accident to regain his life as before. Robotic weapons are adaptable and can be used in a variety of ways.

3.11 Algorithm for robotic arm:



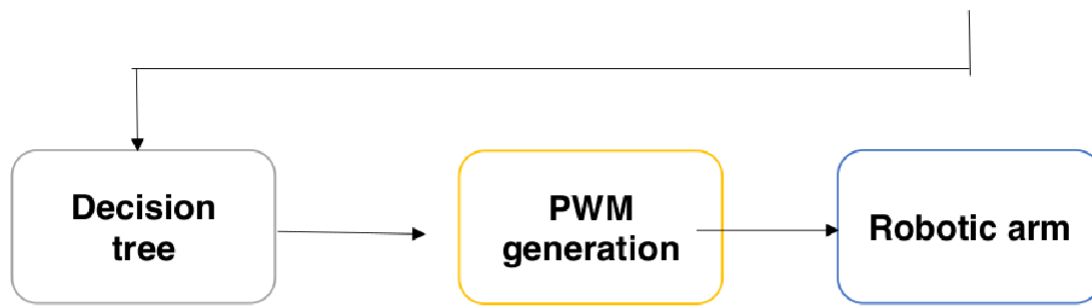


Fig: 1.3 :algorithm for robotic arm

The tcs320 colour recognition sensor module employs a high-quality light sensor that can detect any colour by combining red, green, and blue to detect the target and align it to the data collection set . A data set is a collection of sensor values used for ml algorithm it is a sort of man-made brainpower that concentrate designs out of crude informational collection by utilizing a calculation or technique. ML's main goal is to enable computers to learn from their mistakes without having to be directly programmed or have human interference in the data set . which is already included in ML algorithm matches it and once when the data set gets matched the functions of the decision tree One of the statistical modelling methods used in statistics data mining and learning is decision tree learning. The duty cycle of a square wave is varied when the time is set in a pulse width modulation signal generator, and the robotic arm operates as a result. An artificial arm is a mechanical arm that can be programmed to perform tasks identical to those of a human arm.

3.12Circuit diagram:

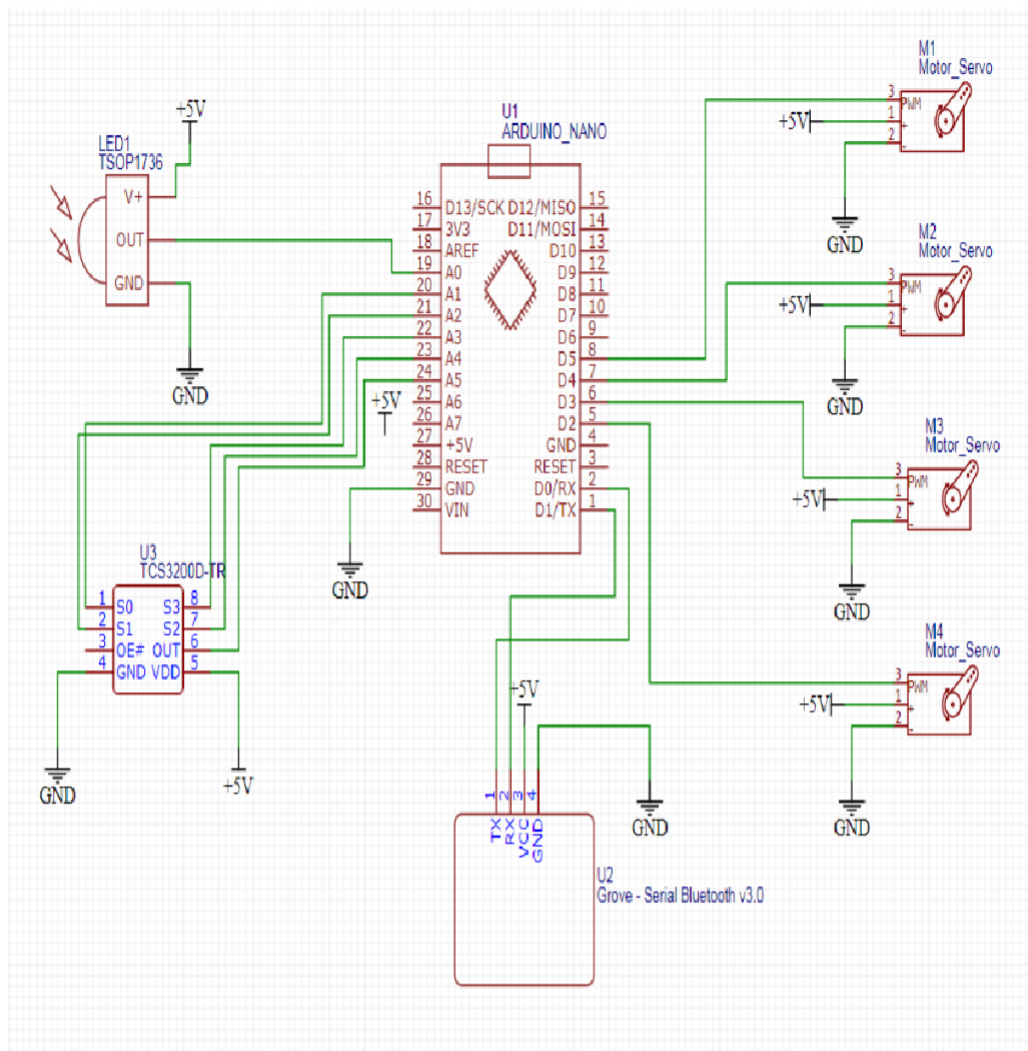


Fig 1.4: circuit diagram

Chapter-4

Experimental or materials and methods algorithms used

4.1. Structure Member:

4.1.1. Basic design: The structure member is robustly designed and built with Aluminum and plywood for improved strength. The structure member is Cartesians type (box) built where aluminum channel form the basic structure along all the axis and plywood become the base. The Dimension of the frame includes 410mm*360mm. the plywood dimension forms a thick Block of 520mm*520mm*18mm. all the frame members are tightened using Fasteners and rigid bold are wont to fix the most frame with the bottom

4.1.2. Improved Stability: The structure member is designed in such a way that can withstand the vibration and deformation created during the quick acceleration of the driver system. column can withstand a maximum load of 1 kg with factor of safety and faster can able to withstand a vibration of amplitude 12.36mm. to prevent deformation of frame will cause dimension error while printing the material is pretested and fastened

4.2 Electronic components:

4.2.1 AVR Microcontroller:

An AVR microcontroller is a type of processor made by Atmel that has advantages over other popular chips. The most straightforward way to think about it is to pair a microcontroller with our PC's motherboard. A microprocessor (Intel, AMD chips) that provides intelligence, RAM and EEPROM memories, and interfaces to the rest of the device, such as serial ports (mostly USB ports now), disc drives, and monitor interfaces, can be found on the motherboard. A microcontroller has all or a significant portion of such highlights built into one chip, eliminating the need for a motherboard, and a large number of segments, such as LEDs, are often connected to the AVR. AVR microcontrollers are available in a variety of packages. Some are designed for through-opening mounting, while others are surface mount. Despite the fact that anything 64-pin or more is surface mount, AVR's are available with 8-pins to 100-pins. A lot of people begin with a DIL (Dual In Line) 28-pin chip, such as the ATmega328 or the 40-pin ATmega16 or ATmega328. The combination of FLASH, EEPROM, and SRAM on a single chip eliminates the need for external memory in many applications.

A few gadgets have an equivalent external transport option to allow for the addition of additional information memory or memory-planned devices. the majority of gadgets (with the exception of the tiniest Tiny AVR chips) provide sequential interfaces that are commonly used to link larger sequential EEPROMs or glimmer chips.

Key Features:

- 32 x 8 general working purpose registers.
- 32K bytes of in system self programable flash program memory
- 2K bytes of internal SRAM
- 1024 bytes EEPROM
- Available in 40 pin DIP, 44 lead QTFP, 44-pad QFN/MLF
- 32 programmable I/O lines
- 8 Channel, 10 bit ADC
- Two 8-bit timers/counters with separate prescalers and compare modes
- One 16-bit timer/counter with separate prescaler, compare mode and capture mode.
- 4 PWM channels
- In system programming by on-chip boot program
- Programmable watch dog timer with separate on-chip oscillator.
- Programmable serial USART
- Master/slave SPI serial interface

4.3 Arduino:

Arduino is an open-source gadgets platform for easy-to-use hardware and programming. Arduino sheets are programmed to recognise inputs - such as a light on a sensor, a finger on a catch, or a Twitter post - and convert them into outputs - such as starting a motor, flipping on a light, or disseminating information on the internet. By submitting a set of instructions to the board's microcontroller, you'll tell it what to try to do. to make an effort to use the Arduino programming language (in light of wiring), and hence the Arduino programming (IDE) supported preparation Arduino sheets have long served as the brains behind a wide range of projects, from simple household objects to sophisticated logical instruments. An entire community of developers - understudies, specialists, craftsmen, software engineers, and experts - has gathered around this open-source platform, and their contributions have

amounted to an enormous volume of open knowledge that would be of tremendous help to both novices and experts.

Arduino was created at the Ivrea Interaction Design Institute as a simple tool for rapid prototyping aimed at students without a background in electronics or programming. The Arduino board started evolving to adapt to new needs and challenges as soon as it reached a larger local market, splitting its offering from simple 8-digit sheets to products for IoT devices, wearables, 3D printing, and embedded conditions. Both Arduino sheets are completely open-source, allowing customers to create them at their leisure and then customise them to their individual needs. The software is open-source, and it is being developed thanks to the contributions of clients all over the world.

4.3.1 Arduino nano:

The Arduino Nano is a small, full, and breadboard-compatible board powered by an ATmega328 (Arduino Nano 3.0) or ATmega168 microcontroller (Arduino Nano 2.x). It's almost the same functionality as the Arduino Duemilanove, but in a different package. It only needs a DC power jack and uses a Mini-B USB connection rather than a standard one. Gravitech is planning and developing the Nano.

4.3.2 Specifications:

- Microcontroller: ATmega328
- Operating Voltage: 5V
- Input Voltage (recommended): 7-12V
- Input Voltage (limits): 6-20V
- Digital I/O Pins: 14 (of which 6 provide PWM output)
- Analog Input Pins: 6
- DC Current per I/O Pin: 40 mA
- DC Current for 3.3V Pin: 50 mA
- Flash Memory: 32 KB of which 0.5 KB used by bootloader
- SRAM: 2 KB (ATmega328)
- EEPROM: 1 KB (ATmega328)
- Clock Speed: 16 MHz

The Arduino Nano is normally powered by a Mini-B USB connection, a 6-20V uncontrolled external force supply (pin 30), or a 5V guided external power supply (pin

27). The office source is, of course, set to the highest voltage possible. If the Nano is powered by USB, the FTDI FT232RL chip on the board is simply operated. As a result, when operating on non-USB input, the 3.3V output (provided by the FTDI chip) is unavailable, causing the RX and TX LEDs to flicker if digital pins 0 or 1 are high.



Fig 2.1: Nano Front view

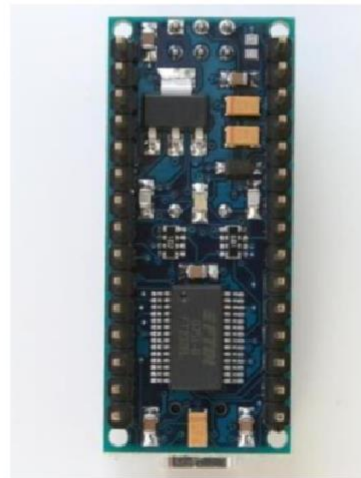


Fig 2.2: Nano rear view

4.3.3 Reason for using Arduino:

- Affordable - As compared to other microcontroller levels, Arduino sheets are reasonably priced. The least expensive version of the Arduino module is frequently collected by hand, and the pre-assembled Arduino modules, interestingly, cost just \$50.

Cross-platform - The Arduino Software (IDE) is compatible with Windows, Macintosh OSX, and Linux operating systems. The majority of microcontroller frameworks are only available for Windows.

- Easy-to-use programming environment- The Arduino Software (IDE) is simple to use for beginners, but adaptable enough for cutting-edge clients to take advantage of as well. It's advantageously supported the Processing programming environment for educators, so understudies learning how to programme in that environment would be familiar with how the Arduino IDE works.

- Extensible and open source programming - Arduino programming is made available as an open source device, enabling professional users to customise it. C++ libraries are often introduced to the language, and those interested in learning

more about the specialised specifics can move from Arduino to the AVR C programming language. You can also use AVR-C programming directly in your Arduino programmes if that's what you want.

- Open source and extensible hardware - The Arduino sheets' plans are released under a Creative Commons licence, allowing professional circuit designers to create their own version of the module, extending and developing it. Indeed, even the most inexperienced clients will create the module's breadboard adaptation and learn how it works and streamline.

4.3.4 arduino kit:

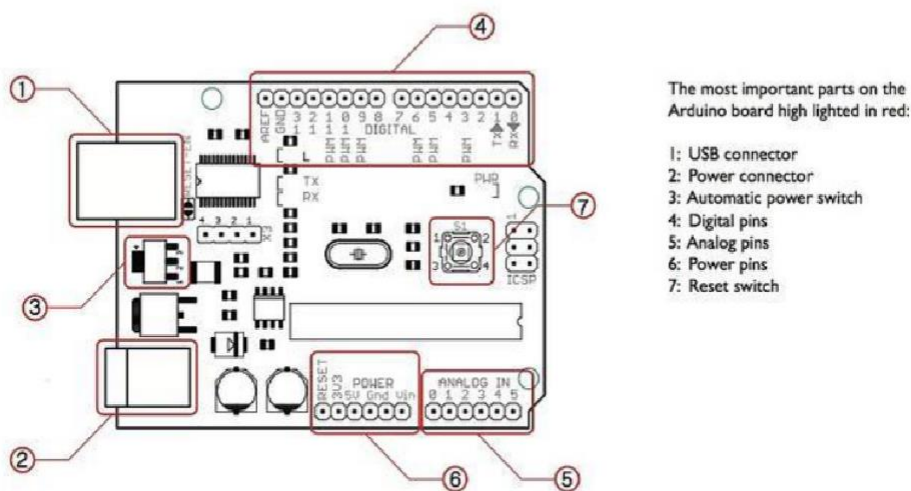


Fig 2.3 :Arduino kit

Architecture:

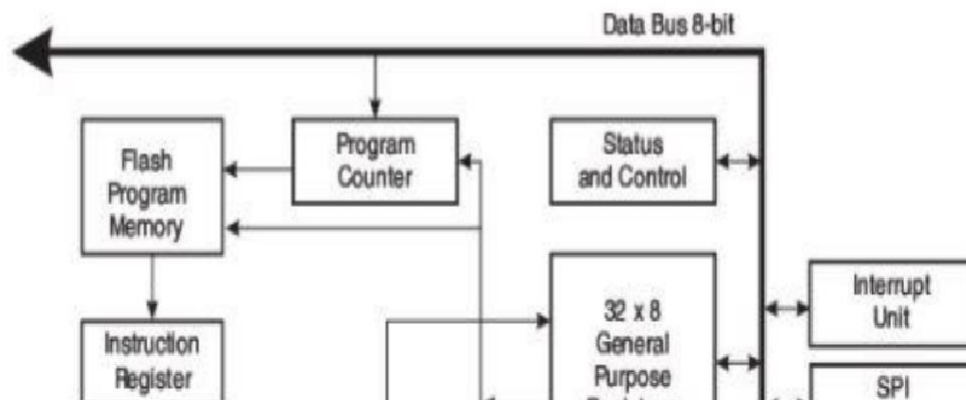


Fig 2.4: Arduino architecture

4.3.5 Analog to digital converter module:

An ADC evaluates a basic waveform over a set of time intervals and assigns a numerical value to each example. In a parallel coded design, the computerised value appears on the converter's output. The value is calculated by subtracting the reference voltage from the tested basic information voltage and multiplying by the number of computerised codes. The yield code's quantity of twofold parts

determines the converter's target. The inspection and quantisation cycles are completed by an ADC.

A basic sign with an unlimited target is addressed by the ADC as a computerised code with a small goal. The ADC generates 2^N computerised values, with N referring to the number of paired yield bits. Since the converter has a small target, the basic knowledge will slip between the quantization stages, resulting in a characteristic vulnerability or quantization blunder. This error determines the converter's most serious special scope. The inspecting loop deals with an indefinite time area signal with values measured at discrete and uniform time intervals. According to Nyquist Theory, this loop determines the signal's most intense propagation power. This theory states that the symbol recurrence should be satisfactory to one with a significant portion of the recurrence to stop associating. Associating is a situation under which recurrence signs outside of a fixed symbol band appear within the transmission speed of interest as a result of the testing interaction.

This associating relationship is, however, often exploited in interchange systems configuration to down-convert a high recurrence sign to a lower recurrence sign. This system is thought to be under-tested.

The ADC's information data transmission capability and complex scope are sufficient to accumulate the very best recurrence sign of interest, which is an indicator of under-testing. Inspection and quantization are important concepts because they set the stage for the presentation of an optimal ADC's farthest ranges. The code changes in an optimal ADC are divided by one least important piece (LSB). There are 2^N codes and $1 \text{ LSB} = \text{FS}/2^N$ for an N -cycle ADC, where FS is the full-scale basic information voltage. Nonetheless, ADC operation around the world is subject to non-ideal effects, which result in errors beyond those caused by converter target and test rate. These errors can be seen in a variety of AC and DC performance parameters for ADCs. Any analogue input code within this set corresponds to a digital output code.

When configuring and using the ADC the following functions must be considered.

- Port configuration
- Channel selection

- ADC voltage reference selection
- ADC conversion clock source
- Interrupt control
- Results formatting

4.3.6 Servo motor:

Three wires or leads are used in servo motors. Ground and positive inventory are supplied to the servo DC engine through two of those wires. The control signal is carried on the third cable. A servo engine's wires have been shade coded. The red wire is the DC supply lead, and it can be connected to a DC voltage supply between 4.8 and 6 volts. The dark wire serves as a grounding wire. For various manufacturers, the tone for the third wire (which provides the power signal) varies. It is typically yellow (if Hitec occurs), white (if Futaba occurs), earthy coloured, and so on. Futaba provides a J-type socket with an extra rib for proper servo association. Hitec is an S-type connector. By removing the extra spine, a Futaba connector is commonly used for a Hitec servo. A Hitec connector is often often used with a Futaba servo simply by documenting the extra width all together so it blends in well. The Hitec splines have 24 teeth, while the Futaba splines have 25. As a result, splines designed for one servo form cannot be used for another. A servo arm is associated with a spline. Its shaft is similar to that of a normal DC engine. Servo engines have been available for a long time and are used in a variety of applications. They are small in scale, but they appear out of nowhere and are very energy-efficient. These features allow them to operate remote-controlled or radio-controlled toy cars, robots, and planes. Modern applications, specialised mechanics, in-line assembly, pharmaceuticals, and food administrations all use servo motors. The servo hardware is built right inside the engine unit and features a movable shaft that is normally equipped with a gear (as shown below). The motor is operated by an electrical signal that defines the amount of shaft movement.

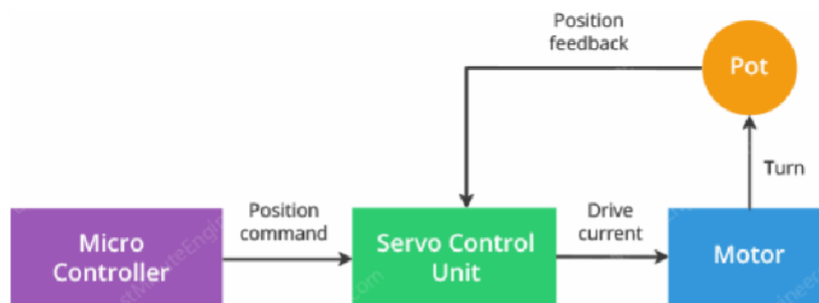


Fig 2.5: working of servo

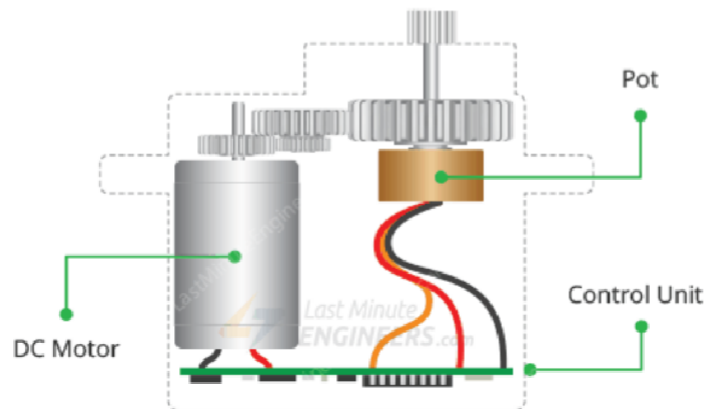


Fig 2.6: inside servo motor module

A closed-loop mechanism is often referred to as a servo. It's a closed-loop mechanism that uses the input signal to control the motor's speed and trajectory in order to achieve the desired effect. A RC servo motor operates on a similar principle. It has a small DC motor that is attached to the output shaft by gears. A servo arm is driven by the output shaft, which is often attached to a potentiometer (pot). The servo control unit receives location criticism from the potentiometer, which compares the actual engine condition to the desired position. dependable with the error, the control unit corrects the engine's particular condition so that it aligns with the objective location. Servos are constrained by transmitting a variable-width electrical pulse, also known as pulse width modulation (PWM), through the control cable. There's a reiteration rate, a base heartbeat, and a greatest heartbeat. A servo engine may usually only turn 90 degrees one way or the other for a total of 180 degrees of production. The unbiased position of the engine is described as the point at which the servo has a similar measure of predicted turn in both the clockwise and counter-clockwise directions. The PWM transmitted from the engine

determines the shaft's location and maintains the duration of the heart beat sent through the control wire; the rotor will handle the predefined location. Every 20 milliseconds (ms), the servo engine aims to detect a pulse, and the duration of the heartbeat can determine how far the engine turns. A 1.5ms heartbeat, for example, would cause the engine to address the 90° spot. More than 1.5ms turns the servo in a counterclockwise direction toward the 0° position, and more than 1.5ms turns it in a clockwise direction toward the 180° position.

When these servos are told to drive, they will move to the specified location and remain in that spot. In the event that an outside force presses against the servo when it is maintaining an edge, the servo will resist shifting out of that position. The force rating of a servo is the most drastic indicator of strength that it can apply. Servos, on the other hand, would not always remain in place; the spot beat should be rehashed to teach the servo to stay in place.

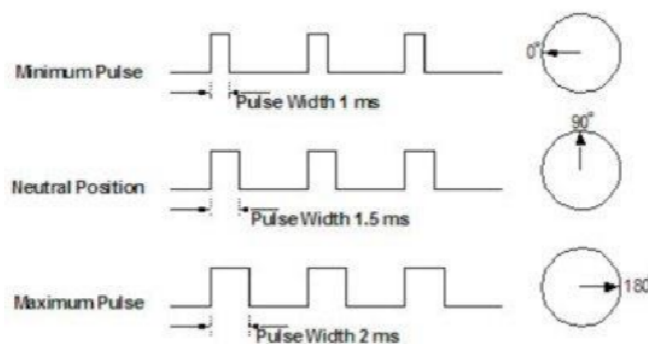


Fig 2.7: Variable Pulse width control servo position

4.3.7.Servo motor SG90:

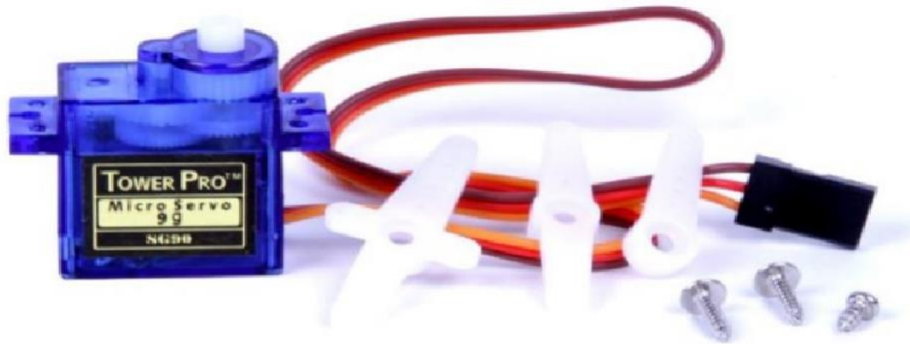


Fig 2.8: Servo motor SG90

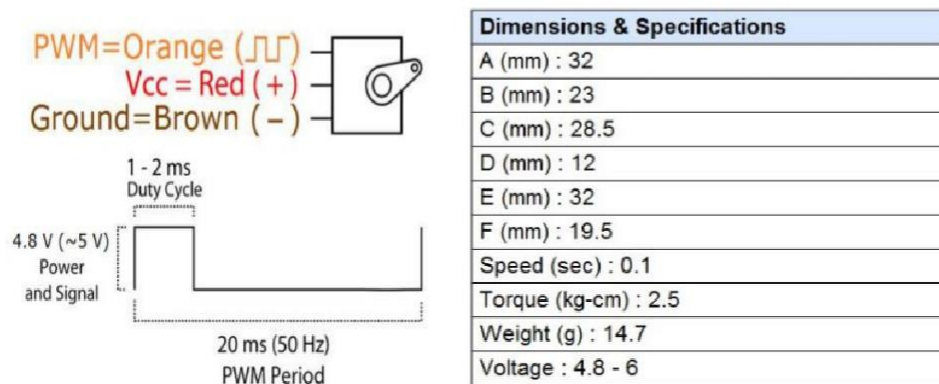


Fig 2.9: pulsewave modulation

With a high performance speed, it's small and compact. The servo can rotate about 180 degrees (90 degrees in either direction) and operates in a similar way to the quality sorts, albeit with less features. To monitor these servos, you can use any servo code, tools, or library. It's especially useful for newbies who need to shift things around without having to instal an engine regulator with input and stuff box, since it can fit in small spaces. It comes with a 3 (arms) and some gear.

4.4 TCS320 color sensor:

Comfortable Silicon Photodiode and Current-to-Frequency Converter are combined on a single solid CMOS coordinated circuit in the TCS320 Programmable Color Light-to-Frequency Converters. The yield is a square wave (half duty cycle) with a recurrence directly proportional to the force of light (radiation). Via two control input pins, the full-scale yield recurrence can be extended by one of three preset

qualities. Advanced data sources and computerised outputs make it simple to connect to a microcontroller or other logic hardware. Enable Yield (OE) In a high-impedance condition, a microcontroller provides yield for several units sharing the information path. The light-to-recurrence converter in the TCS3200 examines photodiodes of 8 x 8 exhibits. Blue channels are present in 16 photodiodes, green channels are present in 16 photodiodes, red channels are present in 16 photodiodes, and no channels are present in 16 photodiodes. The light-to-recurrence converter in the TCS320 looks at 4 x 6 different photodiodes. Blue channels are present in six photodiodes, green channels are present in six photodiodes, red channels are present in six photodiodes, and no channels are present in six photodiodes. To of the effect of non-homogeneity of occurrence radiation, four types (shades) of photodiodes are interconnected. Both photocodes of the same tone are related in the same way. Pins S2 and S3 are used to select which photodiode group (red, green, blue, or clear) is active. The photodiodes are 110 m x 110 m in dimension and have a focus of 134 m.

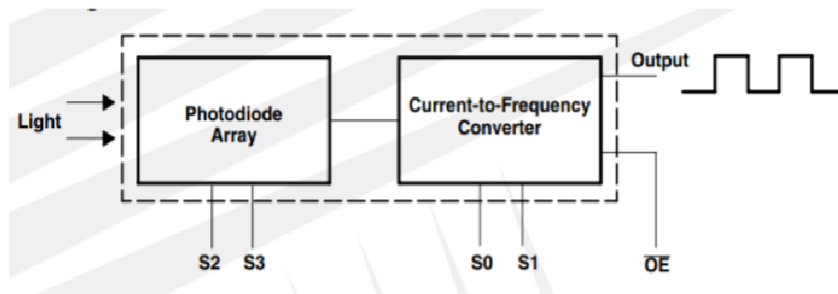


Fig :2.10: Functional block diagram

Configuration:

- High-Resolution Conversion of Light Intensity to Frequency
- Programmable Color and Full-Scale Output Frequency
- Communicates Directly With a Microcontroller
- Single-Supply Operation (2.7 V to 5.5 V)
- Power Down Feature
- Nonlinearity Error Typically 0.2% at 50 kHz
- Stable 200 ppm/°C Temperature Coefficient
- Low-Profile Lead (Pb) Free and RoHS Compliant Surface-Mount Package



Fig 2.11: TCS320 color sensor

4.5 IR sensor:

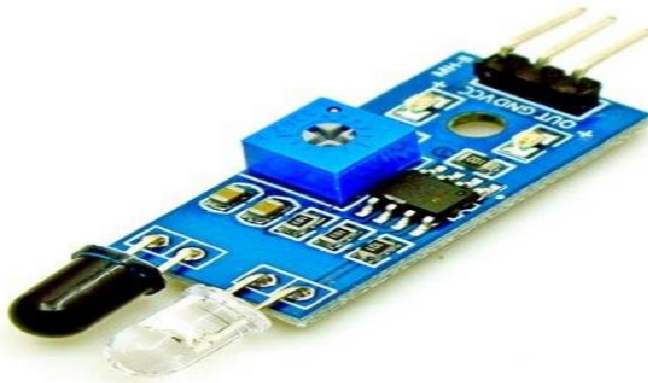


Fig 2.12: IR sensor

4.5.1 IR Sensor Board:

1. Latent or dynamic infrared sensors are common. Infrared locators are the foundation of latent infrared sensors. Uninvolved infrared sensors do not use an infrared source and detect energy emitted by obstructions within the field of vision. There are two types of them: quantum and warm. Warm infrared sensors make use of infrared energy because it is a source of temperature and is frequency independent. Warm infrared locators commonly have thermocouples, pyroelectric

finders, and bolometers.

2. Quantum sort infrared locators are faster than warm sort infrared locators in terms of detection execution. Quantum style locators' photosensitivity is reliably frequency subordinate. They are divided into two categories: inborn and outward. Photoconductive and photovoltaic cells are two types of natural quantum markers.

3. Infrared sensors that are active have two parts: an infrared source and an infrared finder. A LED or an infrared laser diode is used in infrared sources. Photodiodes or phototransistors are used in infrared finders. The infrared source's energy is reflected by an object and lands on the infrared identifier.

4.5.2 IR Transmitter:

A light emitting diode (LED) that emits infrared radiations can be used as an infrared transmitter. As a result, they're known as IR LEDs. While an IR LED appears to be a regular LED, the radiation it emits is invisible to the naked eye.



Fig. 2.13 Infrared LED

Infrared transmitters are classified according to their wavelengths, output capacity, and reaction time. An infrared LED, a current limiting resistor, and an effect supply are often used to make a simple infrared transmitter. A standard IR transmitter's schematic is shown below.

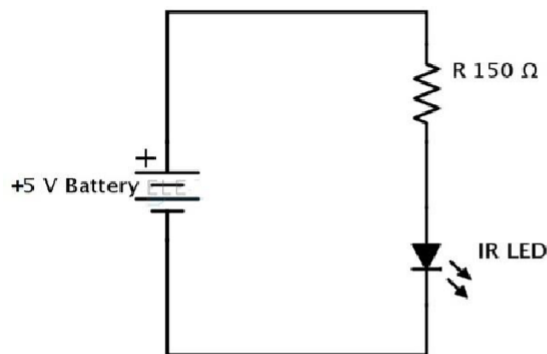


Fig 2.14: schematic diagram for IR transmitter

- The IR transmitter absorbs around 3 to 5 mA of current when powered by a 5V source. Infrared transmitters are tweaked on a daily basis to have a specific frequency of infrared.
- IR transmitters are frequently used in a few systems. • OOK (ON – OFF – KEYING) equilibrium is the most often used control. Infrared heating is needed in a few applications, and the best infrared source in this case is an infrared transmitter. Sun-based cells are commonly generated when infrared producers are combined with Quartz.

4.5.3 Obstacle Sensing Circuit or IR Sensor Circuit:

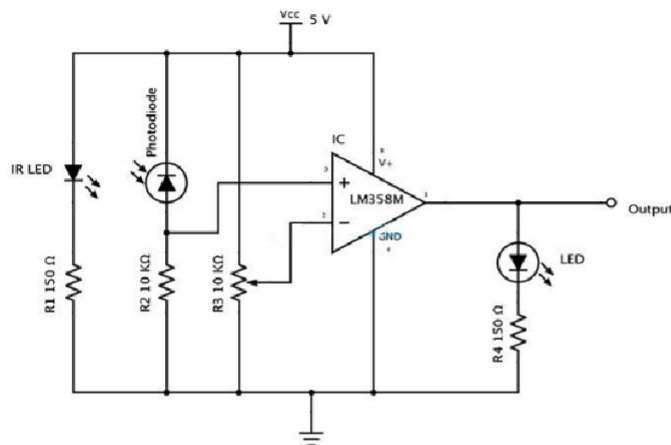


Fig 2.15: IR Sensing circuit

An IR LED, a photodiode, a potentiometer, an IC Operational amplifier, and an LED make up this circuit. The photodiode detects the infrared emitted by the IR LED. As a voltage comparator, an IC Op – Amp is used. The potentiometer is used to fine-tune the sensor's yield to meet the requirements.

When the IR LED's light is incident on the photodiode after touching an object, the photodiode's opposition falls from a high value. One of the contributions of the operation – amp is at the potentiometer's limit value. The structure resistor of the photodiode makes a negative addition to the process amp. The decrease around the structure resistor would be high when the incident radiation is higher on the photodiode. Both the edge voltage and, as a result, the voltage around the arrangement resistor are considered in the IC. The yield of the IC Op – Amp is high if the voltage around the resistor structure to photodiode is greater than the edge voltage. It becomes easier because the IC's yield is linked to an LED. Depending on the environmental conditions, the edge voltage is constantly modified by adjusting the potentiometer. The location of the IR LED and, as a result, the IR Receiver is crucial. This arrangement is known as Direct Incidence since the IR LED is held directly in front of the IR collector. In this scenario, almost all of the IR LED's radiation would land on the IR collector. As a result, there is direct contact between the infrared transmitter and the receiver. If an object comes into contact with this line, it either reflects or absorbs the radiation, preventing it from reaching the receiver.

4.5.4 Distinguishing Between Black and White Colors:

It is universally accepted that black colour absorbs all incident radiation while white colour represents all incident radiation. The second positioning of the sensor pair is frequently done if this law is followed. The photodiode and the IR LED are placed next to each other in this manner. Since there is no direct line of communication between the transmitter and the receiver when the IR transmitter emits infrared, the discharged radiation should reflect back to the photodiode after reaching some post. The thing's outside is usually divided into two types: intelligent surface and non-intelligent surface. If the thing's outside is intellectual in nature, such as white or another light tone, the rest of the radiation would be reflected back to arrive at

the photodiode. Present flows within the photodiode depending on the intensity of the reflected radiation.

If the exterior of the item is non-intelligent in nature, such as gloomy or other flat tones, it retains the majority of the radiation episode as a result. Since there is no reflecting radiation, there is no radiation on the photodiode, and as a result, the obstruction of the photodiode remains stronger, preventing current from flowing. This model is essentially the same as having no object at all.

4.6 Bluetooth Module HC-05:

- It's used in a variety of applications, including remote headsets, game controllers, remote mice, remote consoles, and a variety of other shopper applications. •It has a range of up to 100 metres, depending on the transmitter and receiver, as well as the weather, regional, and metropolitan circumstances.

- It is an IEEE 802.15.1 standardised convention for constructing a remote Personal Area Network (PAN). It sends data over the air using recurrence bouncing spread spectrum (FHSS) radio technology.

- It communicates with devices using sequential correspondence. It communicates with the microcontroller through the sequential port (USART).

- The HC-05 is a Bluetooth module designed for remote communication. This module can be used as either an expert or a slave.

HC-05 module has two modes,

1. **Data mode:** Data transfer between devices.

2. **Command mode:** It makes use of AT instructions, which are used to adjust the HC-05's settings. The module sequential (USART) port is used to transmit these instructions.

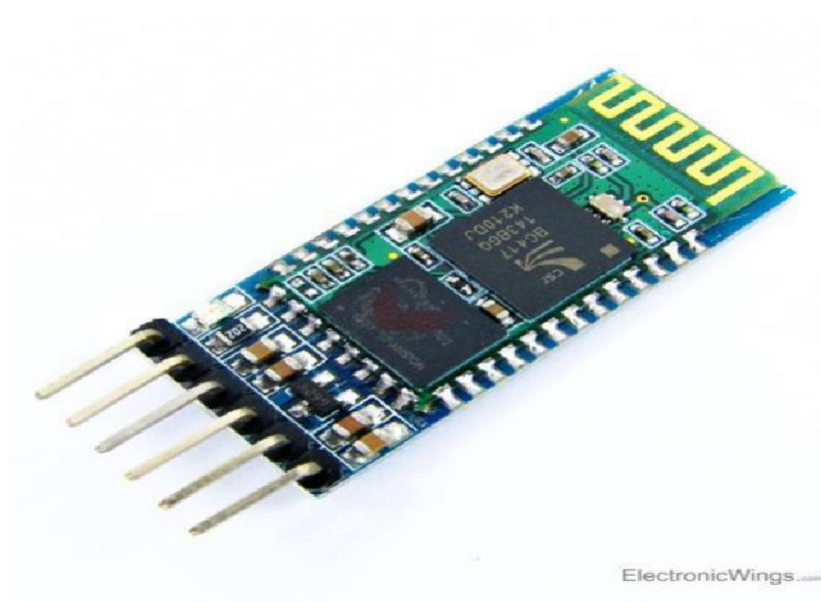


Fig 2.16: HC-05 Bluetooth Module

4.6.1 Pin Description:



Fig 2.17: pin description

It has 6 pins,

1. **Key/EN:** Bluetooth module AT orders mode is a common occurrence. This module can run in order mode if the Key/EN pin is set to big. In any case, it's in knowledge mode by default. In order mode, the HC-05's default baud rate is 38400bps, and in information mode, it's 9600bps.

2. **VCC:** Connect 5 V or 3.3 V to this Pin.
3. **GND:** Ground Pin of module.
4. **TXD:** Serial knowledge is communicated (remotely got information by Bluetooth module sent out sequentially on TXD pin)
5. **RXD:** The transmission of serial intelligence (remotely got information by Bluetooth module sent out sequentially on TXD pin)
6. **State:** It tells whether module weather it is connected or not.

4.6.2 Bluetooth communication between Devices:

To use the HC-05 Bluetooth module with a mobile phone, you'll need a Bluetooth terminal programme to transmit and receive data. In a different device store, you'll find Bluetooth terminal apps for Android and Windows. As an example, Send data from a Smartphone terminal to the HC-05 Bluetooth module, then view it on a PC serial terminal, and vice versa.

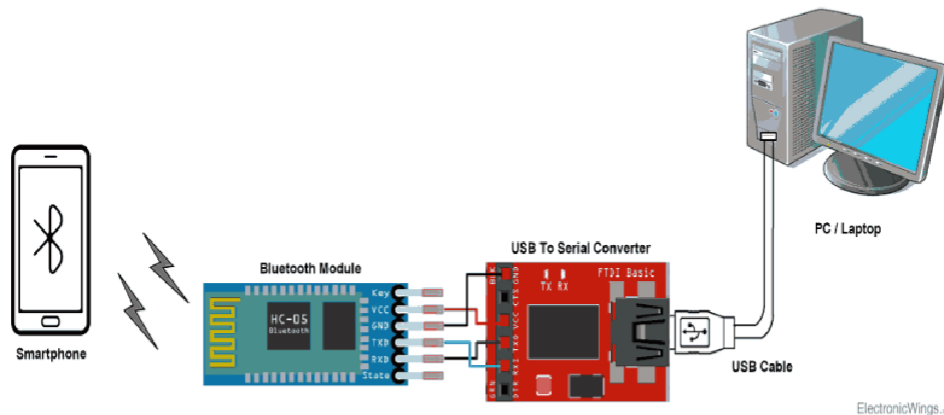


Fig 2.18: Bluetooth Module Serial Interface

As a result, when using a mobile phone with the HC-05 Bluetooth module, connect the HC-05 module to the PC using a sequential to USB adapter. We'd like to connect the HC-05 module with the smartphone for connectivity before creating communication between two Bluetooth devices.

4.6.3 Pair HC-05 and smartphone:

1. Use your phone to look for a new Bluetooth kit. A Bluetooth computer with the code "HC-05" can be found.
2. Click the associate/pair gadget option; the HC-05's default pin is 1234 or 0000. After you've combined two Bluetooth gadgets, open terminal programming (for

example, Tera term, Real term, and so on) in your PC and choose the port where the USB to sequential module is connected. Similarly, choose 9600 bps as the default baud rate.

- Open the Bluetooth terminal programme on your handset and connect it with the HC-05 combined gadget.

- It is simple to communicate; all we need to do is type into the Bluetooth terminal programme on our smartphone. Characters will be sent to the Bluetooth module HC-05 via a remote connection. As a result, the HC-05 will transmit it sequentially to the PC, which will appear on the terminal. We'll send data from a PC to a mobile phone in the same way.

4.6.4 Command Mode:

- When we choose to adjust the settings of the HC-05 Bluetooth module, such as the hidden word for association, the baud rate, the name of the Bluetooth device, and so on

- To do this, the HC-05 has AT orders.

- Connect the "Key" pin to High to use the HC-05 Bluetooth module in AT order mode (VCC).

- The HC-05's default baud rate in order mode is 38400bps.

- The following AT commands will, for the most part, adjust the Bluetooth module's settings.

- To transmit these instructions, we'll use a sequential to USB converter to connect the HC-05 Bluetooth module to the PC and communicate the commands via the PC's sequential terminal.

Command	Description	Response
AT	Checking communication	OK
AT+PSWD=XXXX	Set Password e.g. AT+PSWD=4567	OK
AT+NAME=XXXX	Set Bluetooth Device Name e.g. AT+NAME=MyHC-05	OK
AT+UART=Baud rate, stop bit, parity bit	Change Baud rate e.g. AT+UART=9600,1,0	OK
AT+VERSION?	Respond version no. of Bluetooth module	+Version: XX OK e.g. +Version: 2.0 20130107 OK
AT+ORGL	Send detail of setting done by manufacturer	Parameters: device type, module mode, serial parameter, pass key, etc.

4.7 POWER SUPPLY:

Almost all electronic devices in electronic circuits need a dc power source to function. The dc operating points (Q-points) for the passive and active electronic devices embedded into the system are determined using the dc power source. In most electronic systems, the dc power supply is linked to each and every point. It means that the only condition that applies to all or most phases of electronics is a source of dc electricity. For convenient low-power frameworks batteries could likewise be utilized, yet their working period is confined. Accordingly for while activity successive re-energizing or substitution of batteries become a lot costlier and complex. However, more often than not, gear is energised by an impact source, which is obtained by changing, amending, and filtering a quality modern or homegrown ac supply. (A typical dc power supply, also known as an unregulated force supply, is made up of a transformer, a rectifier, and a channel.) As seen in the diagram, a controlled power supply consists of a normal power supply and a voltage guiding device. The output of a typical force supply is directed to a voltage-controlling device, which produces a definite output.

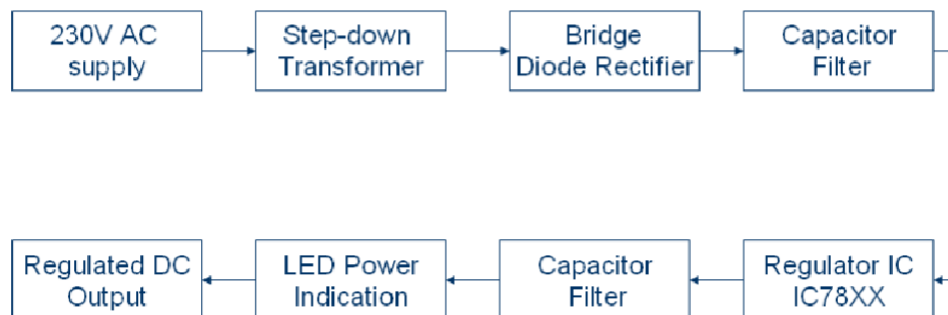


Fig 2.19: Block Diagram of RPS

Graph of Regulated Power Supply

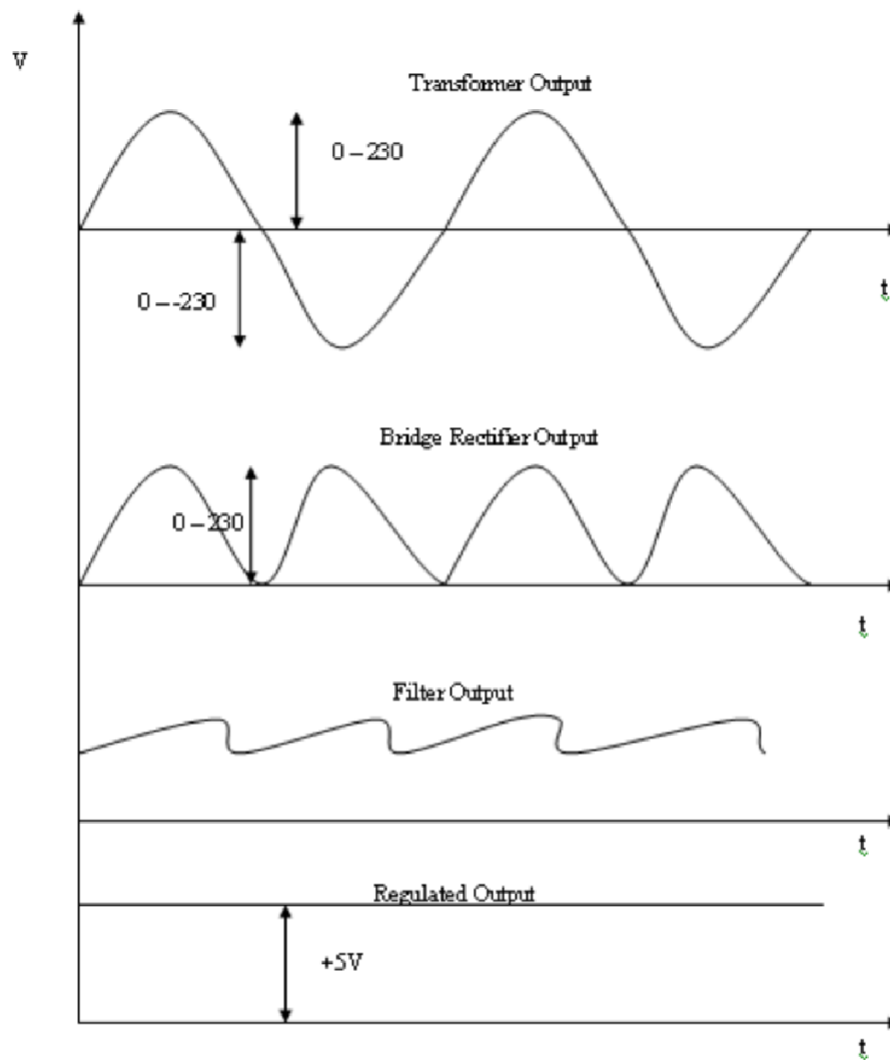


Fig 2.20: Output of RPS

SOFTWARE PROFILE

4.8 PROTEUS:

Proteus may be a circuit simulation AND virtual system modelling tool. The software combines blended mode SPICE circuit reenactment, energised components, and chip models for co-creation of full microcontroller-based plans. Proteus can also simulate the interaction between microcontroller programming and any basic or advanced devices that are connected to it. It imitates Input/Output ports, as well as clocks, USARTs, and all other peripherals found on each supported cpu.

4.9 ARDUINO IDE:

the original It's possible that the Arduino is a microcontroller board based on the ATmega328 (datasheet). It has 14 electrical input and output pins (six of which are commonly used as PWM outputs), six analogue inputs, a 16 MHz ceramic resonator, a USB connector, an impact jack, an ICSP header, and a push button. Its architectures have aids that help the microcontroller in any way possible. To use it, you must first attach it to a computer via USB or force it with an AC-to-DC connector or battery. It's available in two distinct forms: Arduino Uno and Genuino Uno, both of which can be pictured. The variations are visible in relation to the location. The Uno differs from its predecessors in that it does not make use of the FTDI USB-to-chronic driver chip. In Italian, "uno" means "one," and it was given the name to signal the imminent arrival of Arduino 1.0. Inside the forward venture, the Uno and adaptation 1.0 are the reference renditions of Arduino. Uno USB is the most current Arduino sheet in the series, and is thus the Arduino stage's reference model. A content manager, a message field, a book support, a toolbar with catches for routine assignments, and a progression of menus for writing code make up the Arduino Integrated Development Environment, or Arduino Software (IDE). This software connects to Arduino and Genuino devices to move data and communicate with them. Charts are projects created with the Arduino Software (IDE). These sketches are created in the content tool and stored as an expansion.ino file. Cutting/sticking and looking/evolving text are highlighted by the proofreader. The message area responds to saving and selling, as well as displaying errors. The help displays text produced by the Arduino Software (IDE), which includes complete error messages and other information. The built board and gui can be

seen in the window's bottom right corner. You can use the toolbar buttons to search and switch programmes, create, open, and save drawings, and access the chronic screen.

4.10 REINFORCEMENT LEARNING:

Reinforcement Learning (RL) is a form of learning that is based on positive reinforcement. When it comes to tossing things to a target, we don't give it much thought; we just chuck. The truth is that our brain is wired in such a way that when we throw, we don't have to think or calculate. However, upon closer inspection, we discovered that throwing is a very difficult and time-consuming activity. Many equations and considerations are involved, as well as angular arm motions. These stuff, as a person's, are very easy, and we often overlook their wisdom. When it comes to throwing, we don't pay attention to what we're holding; instead, we focus on the target. To strike the mark, the brain approximates the force to use, the angular motion of the fist, and hence the timing to release the thing. Implementing this on a robotic arm is a difficult process. The device should be self-contained, taking goal data from the cameras and processing it in order to map all of the necessary variables in real time. Determining and predicting the direction on which the object will fly is also a crucial job, since if the thing is freed from the hold, there is no way to manage it in the air. For doing this job creatively, we suggest reinforcement learning. The framework will teach itself to toss and improve its precision in order to strike a target. In general, precise preparation of the details from the camera to the world measure is critical. For this, we suggest starting with a few subjective variables and keeping track of the outcomes of each effort. Tossing for arbitrary values at first, what will either climb above the goal or will essentially miss the mark. just in case the thing goes above the limit set it as F_{max} (Maximum required value to hit the target). When the thing drops before reaching the target in certain iterations, set it to F_{min} (Min necessary value to hit the target). Now that you have F_{max} and F_{min} , use binary search to find an optimal mapping scaling factor. Getting the correct value will take multiple iterations. Change the goal spot until you've had this ideal element of scaling and mapping, and the arm can throw the thing and catch the target with the first arrow. During this process, the machine learns and strengthens itself by

reinforcement learning. This makes the structure more complex and allows for the addition of different environments. This can be used to sort items for commercial or domestic purposes, as well as to play games like Dart. Playing darts against the robotic arm would be a lot of fun.

Chapter – 5

5.0 Results and Discussion, Performance Analysis

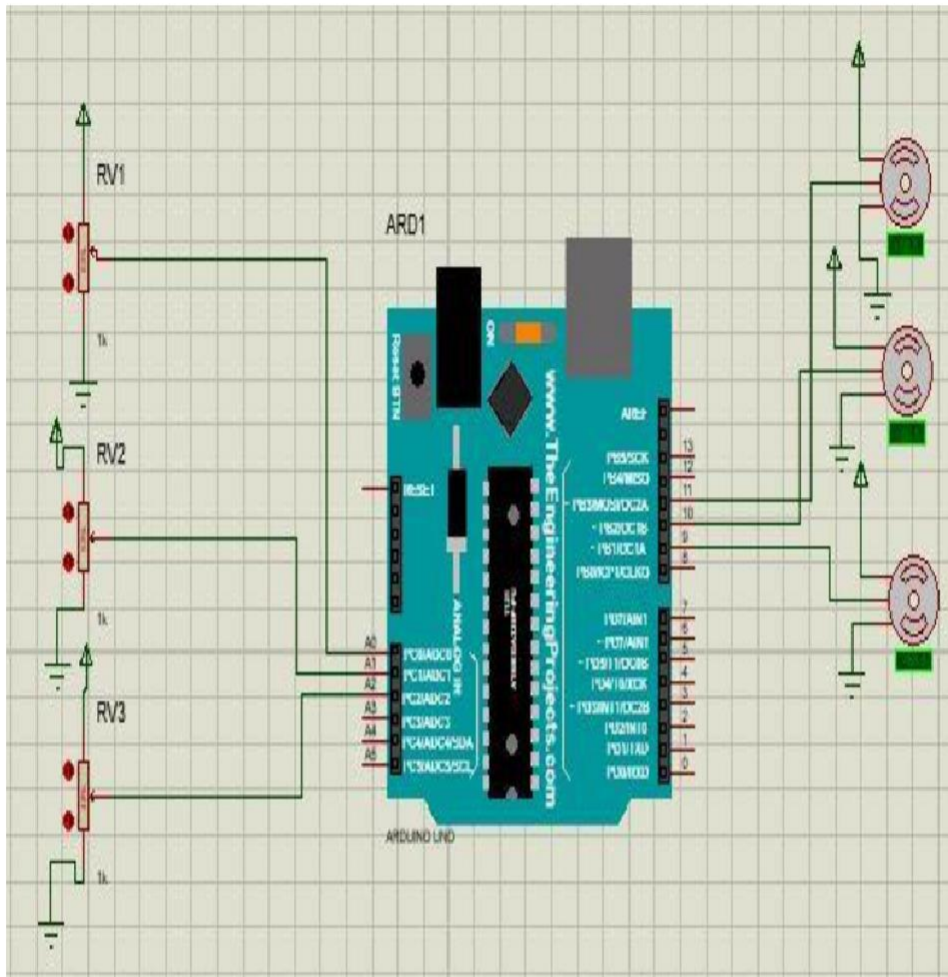
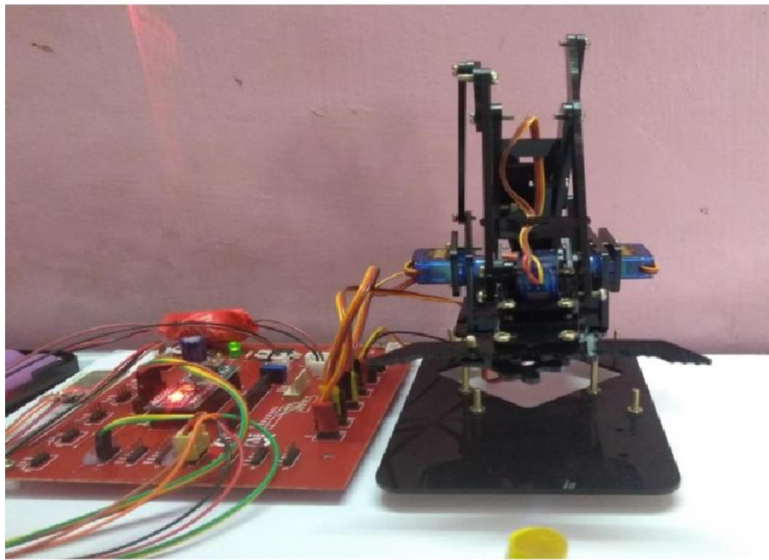
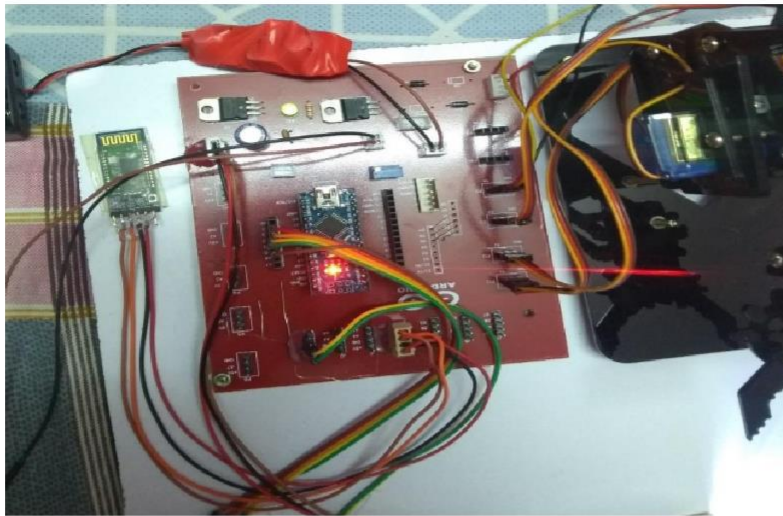
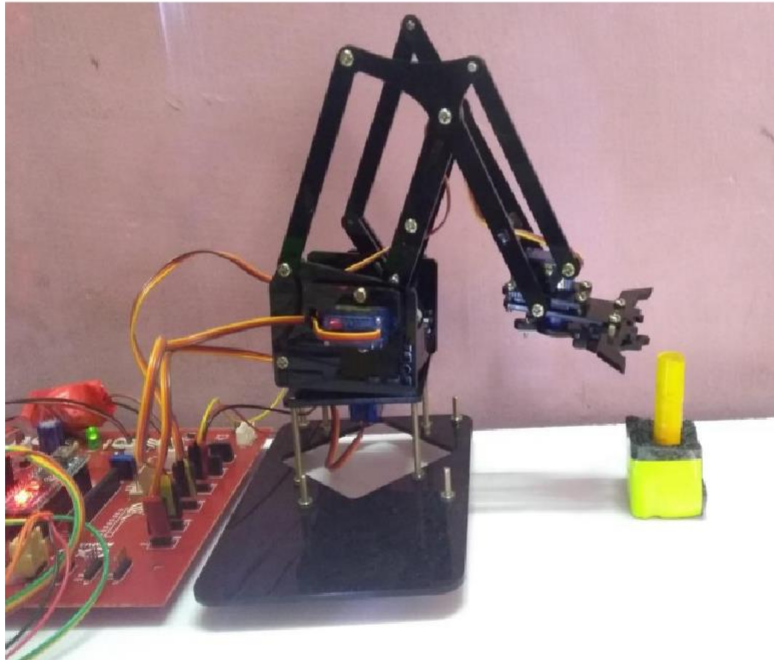
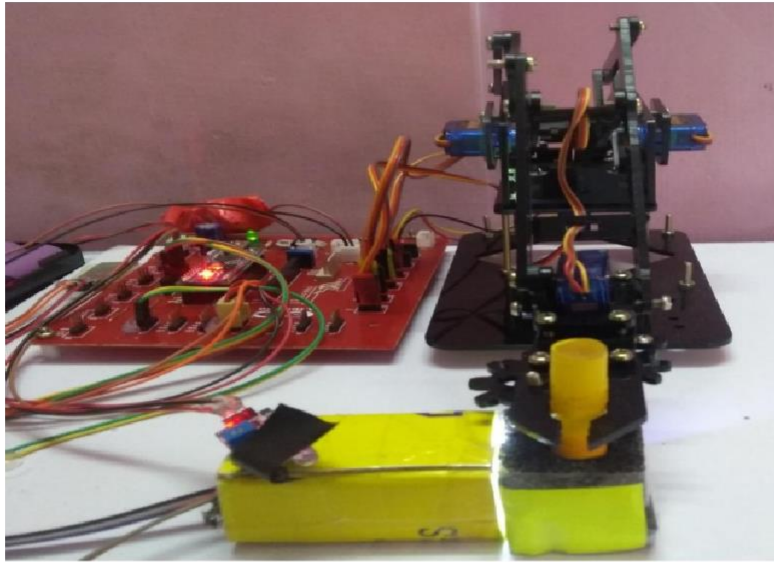


Fig 3.1: simulation result

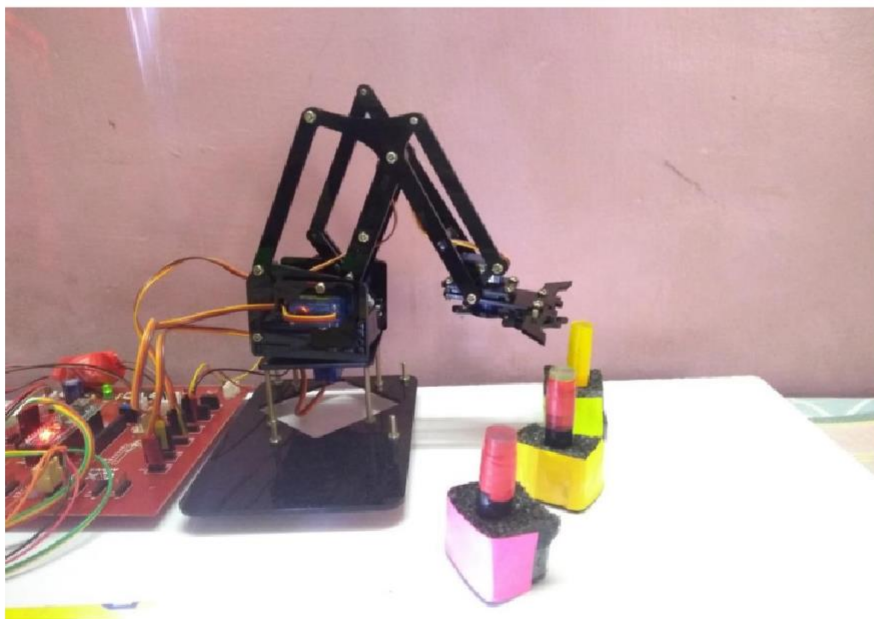
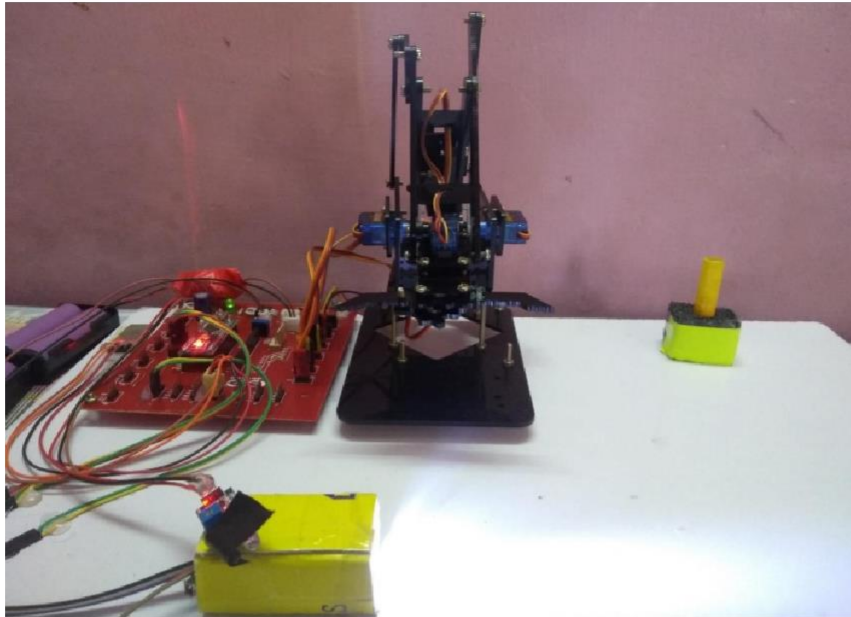
5.1 Final result:



- After power on every device is powered and it searches for the object
- A colour recognition procedure is carried out. The tcs320 colour sensor module employs a high-quality light sensor that allows us to detect any colour by combining red, green, and yellow light.



- When the object is detected (green) position is decided after which the 4DOF robotic arm with similar function of a human arm picks and places the object to its corresponding position (position1 green)



Bluetooth Terminal HC-05

ASCII



Connected to gesture

[Mar 2, 2021 9:43:57 PM] ASCII:

R= 12G= 45B= 7BLUE:6

R= 17G= 19B= 7RED:.....

RED:5

R= 14G= 26B= 8Black:2

- After placing the object the arm return back to its home position and when the second object is detected (yellow) it places it on position 2 followed by the third object (red) in position 3
- And the live update of the system is obtained.

Chapter – 6

6.0 Summary and Conclusions

6.1 FUTURE SCOPE:

Robotic Arms has a wide production spectrum. In the not-too-distant future, weapons will be capable of doing any job that humans do, and in a much better manner. The only limit to its possible applications is one's imagination. It is frequently a lifesaver for handicapped individuals who have been paralysed or have lost their hands due to an injury. The arm is often taught to focus on a person's order and execute the duty. It is also possible to use a gesture-controlled device. Wearable sensors are sometimes used to transmit commands and monitor arm motions. BCI (Brain Computer Interface) is a rapidly growing area of study. BCIs are often used to collect impulses from the brain and activate the limb. The machine will add in the same way as a human arm can. Such artificial arms enable a person who has lost his hand in an accident to regain his life as before. Robotic weapons are adaptable and can be used in a variety of ways.

6.2 CONCLUSION:

Our thesis on early robotic arm research and development is presented in this project. We would go into the simple mathematical model of weapons that can be used to execute the arm. Despite years of study, robotic arm implementations are limited to sectors and are mainly found in industrial units to increase productivity. These weapons are highly advanced and capable of making extremely precise gestures. Robotic weapons also have a wide range of general-purpose and domestic uses that have yet to be fully investigated. The biggest limitation on robotic arms is cost, and lowering it is a difficult task. The construction of these devices necessitates the use of high-torque, high-precision servos. These are the most costly materials which are the ones that allow the arm to move. Finding solutions to these motors in order to reduce costs is a must. And, the substance used by the body should be light and long-lasting. The motors' performance and torque can be improved by the light weight body. The materials and pieces come in a variety of shapes and sizes, depending on the application. It's a difficult task to get these devices to the point that they can be sold as a commodity for general-purpose use. If these issues are overcome, robotic arms will be visible anywhere as a "helping hand" in no time.

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