A

PROJECT REPORT

ON

"SMART TRAVELLING BAG FOR DISABLED PEOPLE"

SUBMITTED BY

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SAVITRIBAI PHULE PUNE UNIVERSITY

2021-2022

Dissertation Approval Sheet

This is to certify that the project work titled "SMART TRAVELLING BAG FOR DISABLED PEOPLE", has been submitted in partial fulfillment of the Bachelor'sdegree in Electronics and Telecommunication during the academic year of 2021-2022 by following students:

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This project confirms to the standards laid down by the Savirtibai Phule Pune University and has been completed in satisfactory manner as a partial fulfillment for the Bachelor's degree in Electronics and Telecommunication Engineering.

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ABSTRACT

Wheelchair users might face a difficult time carrying their luggage while travelling. Our aim is to develop a human following smart bag using raspberry pi, capable of maneuvering through busy places such as airports, railway stations, etc. behind its owner. To achieve this target the goal of our work is to design and fabricate a smart bag that not only tracks the target(owner) but also moves towards by avoiding obstacles while tracking.

We consider a method using image recognition and object tracking for the same. A small pi camera continuously captures the images of the unique tag and continuously compares it to the original captured image. If it is matched, then the trolley moves further and also it makes its way to proceed further by avoiding obstacles by using ultrasonic sensors. GPS module is also used to notify the user regarding the bag's live location via google map by using API. This will be useful in case the bag got stolen or is lost.

ACKNOWLEDGEMENT

The success and final outcome of this project required a lot of guidance and assistance from many people and we are extremely privileged to have got this all along the completion of our project. All that we have done is only due to such supervision and assistance and we would not forget to thank them. We would like to express our respect and thanks to the people who have helped us most throughout our project.

We express our gratitude to **Prof. Dr. D. M. Chandwadkar**Head of Department of Electronics and Telecommunication for his constant encouragement, co-operation and support. We are grateful to our project guide **Prof. Puja Patil** for nonstop support for the project. We express our sincere thanks to Staff of E&TC Department for their unfailing inspiration.

We are also thankful to lab faculty for providing the lab facilities. A special thanks of us goes to ourselves for everyone's precious contribution in completing the project, where everyone exchanged his own interesting ideas, thoughts and made this possible to complete our project with all accurate information.

We wish to thank our parents for their personal as well as financial support and attention who inspired us to go our own way. At last, but not the least we want to thank our friends who treasured us for our hard work and encouraged us.

Finally, I wish to thank my parents for their support and encouragement throughout my study.

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CERTIFICATE

This is to certify that _____

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others have / has succesfully completed the project work

On _____

_____ *'in*

Partial fulfilment of the Bachelors Degree in.

_____ *Engineering during the*

academic year _____

PRINCIPAL

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1 Introduction

1.1 Introduction

Automatic or automation means, as by electronic devices, reducing human intervention to a minimum. This Project aims at reducing the time delay and human efforts in the luggage management system. Everybody uses Traveling bag to travel, especially at the airports and have to drag their own heavy bag themselves. Passenger need to carry their own luggage. This is a very labor-intensive process and it becomes a hectic journey, the problem becomes bigger when it comes to people with some disability or injury. This problem can be overcome by the automatic luggage follower system that is a smart traveling bag. It reduces the time delay and human efforts in luggage management.

This project aims to help people with disabilities to carry their luggage easily as the smart bag will follow their path at a particular distance behind them. It will be able to recognize and follow the path of the person at a fixed distance with the help of image recognition and object tracking. GPS module is also used to notify the user regarding the bag's live location via google map by using API. This will be useful in case the bag got stolen or is lost.

1.2 Need Of Project

The luggage bag which is used in today's world is hand driven posing problems like exhausting human energy and not equipped with state-of-the art safety features by means of automatic passenger intervention will be reduced to a minimum result of which will reduce the delay time and human efforts in luggage management system. In today's time everybody carries a luggage bag for travel especially to airport and almost all of them are dragging out heavy luggage bag.

Every Passenger has to carry its luggage on its own which most of the time is very slow and tiring process because of heavy nature of luggage and journey becomes unpleasant. This problem is even greater if the person is disabled or they are wheal chair user as they have to depend on someone else to help them carry their heavy luggage. This same problem is also faced by many aged people as due to age their weight carrying capacity reduces, this result in exhaustion for them while traveling especially while traveling for longer distances.

Automatic luggage follower bag is solution to this problem. It can also be called as smart luggage because of its automation.

1.3 Scope of Project

Automated luggage carrying system in airport and railway stations has great scope in every country in the world. Luggage handing is always a task while travelling. Reducing the manpower required to distribute the baggage as required and efficiency in terms of reliability, maintainability and future flexibility are the main motivation of this automated luggage carrying system. This automated luggage carrying bag is designed to follow the owner automatically having a specific tag at a particular distance in the airport would be barely even touched by the human hands once they were loaded into the automated system. If the environment of the airport and railway station fully supported the demands of the automated system, it will become much more easy and effective in future to work with this automated system.

1.4 Objectives of Project

- A luggage easy to be carry and to be manageable by any person.
- Comfortable cost according to everyone's perspective.
- o identify the efficiency of convention luggage carrying system and the proposed system.
- To demonstrate the benefits of Smart travelling bag over conventional traveling bag considering some important parameters such as speed, time, human labor and cost expenses.
- To identify the drawbacks of current conventional system.
- To demonstrate the scope of improving the proposed automated luggage carrying system.

1.5 Gantt chart

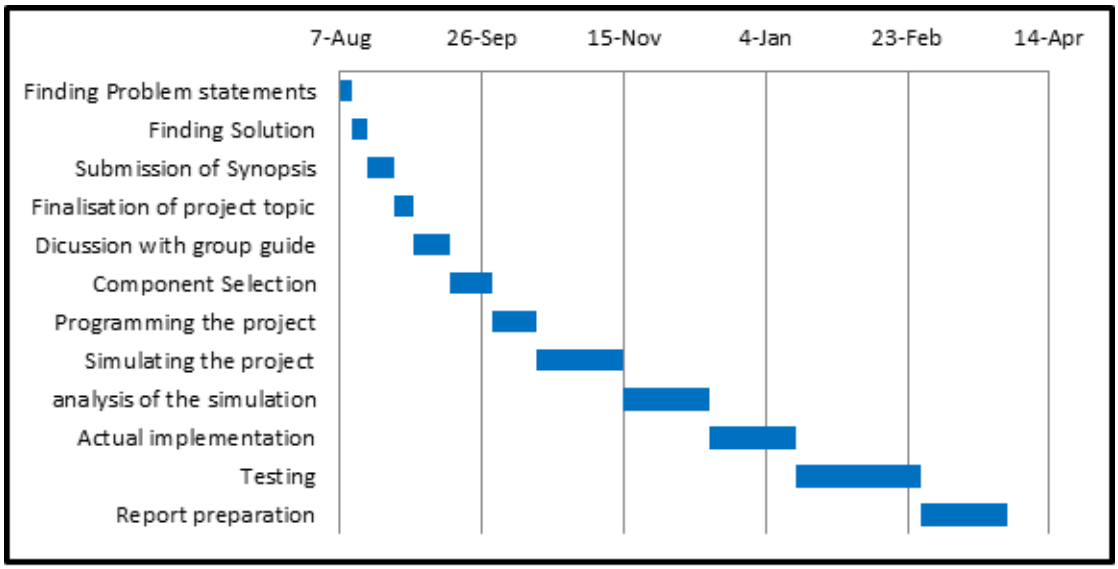


Figure 1.5.1: Gantt chart

2 Literature Survey

In recent years a great deal of time and effort has been spent on developing systems to enable an automatic travelling bag to follow users using object tracking. Not surprisingly, the majority of this research has been towards modifying or designing from scratch, and to make an automatic tracking bag or trolley so that it can reduce human effort to carry heavy luggage.

This paper[1] represents the human following trolley using a raspberry pi. The target is to design and fabricate a robot that follows a unique tag which is placed on the user. Small pi camera continuously captures the images of the unique tag and continuously compares it to the original captured image. If it is matched, then trolley moves further.

This paper[2] give details about how object has to be unique for the robot to recognize it and carry out the objective. The simple tag removes this problem of uniqueness and makes the task fairly easy. A small camera records the video and the processor processes it to extract the desired information from it. Protecting the robot from collision with the object can be tackled using a sensor.

The vehicle tracking system[3] uses the GPS module to get geographic coordinates at regular time interval. The GSM module is used to transmit and update the vehicle location to a database. This paper gives minute by minute update about vehicle location by sending SMS through GSM modem.

For human detection[4] ultrasonic sensor is used which also help in distance measurement. For safety features GSM and GPS are used which help to locate the automatic bag in case its lost. Raspberry pi is used to integrate all the electronic components used in the project.

This paper[5] presents a complete integrated control architecture and communication strategy for a system of reconfigurable robots that can climb stairs. Its mechanical design is suitable with back wheel to drive the robot over rubble, and large wheels in the front driven by dc motor for climbing stairs.

Smart travelling bag are independent of any human effort and can follow them on their own. The smart travelling bag is designed in such a way that the image taken from the camera will be calculated. If it matches the valid sticker's value, then the trolley will follow that person who has a specific sticker by maintaining a constant distance from that person. The distance calculated using ultrasonic for keeping a fixed distance between the user and the trolley. The designed model was confined with a boundary like hospitals and shopping malls. The same approach with some improvements could be used in other fields like schools and colleges, libraries, agricultural fields, war fields, etc.

A more elaborate version of the same idea is used by more advanced bags, new sensor systems and algorithms can make them more perceptive and smarter. Obstacle avoidance can be implemented as a reactive control law, whereas path planning involves the pre-computation of an obstacle-free path which a controller will then guide bag along.

3 Design Methodology

3.1 System requirements and Specifications

3.1.1 Raspberry Pi 4b

RASPBERRY PI 4 is a development board in the PI series. It can be considered as a single board computer that works on the LINUX operating system. The board not only has tons of features it also has terrific processing speed making it suitable for advanced applications. PI board is specifically designed for hobbyists and engineers who are interested in LINUX systems and IOT (Internet of Things).

Raspberry Pi 4 Model B is the latest product in the popular Raspberry Pi range of computers. It offers ground-breaking increases in processor speed, multimedia performance, memory, and connectivity compared to the prior-generation Raspberry Pi 3 Model B+, while retaining backwards compatibility and similar power consumption. For the end user, Raspberry Pi 4 Model B provides desktop performance comparable to entry-level x86 PC systems.

This product's key features include a high-performance 64-bit quad-core processor, dual-display support at resolutions up to 4K via a pair of micro-HDMI ports, hardware video decode at up to 4Kp60, up to 4GB of RAM, dual-band 2.4/5.0 GHz wireless LAN, Bluetooth 5.0, Gigabit Ethernet, USB 3.0, and PoE capability (via a separate PoE HAT add-on).

The dual-band wireless LAN and Bluetooth have modular compliance certification, allowing the board to be designed into end products with significantly reduced compliance testing, improving both cost and time to market.

Figure 3.1.1: Raspberry Pi 4b

Specification:

- Broadcom BCM2711, Quad core Cortex-A72 (ARM v8) 64-bit SoC @ 1.5GHz
- 2GB RAM.
- 2.4 GHz and 5.0 GHz IEEE 802.11ac wireless, Bluetooth 5.0, BLE
- 2 USB 3.0 ports; 2 USB 2.0 ports.
- 100 Base Ethernet
- 40-pin extended GPIO.
- 5V DC via USB-C connector (minimum 3A*)
- Operating temperature: 0 – 50 degrees C ambient

3.1.2 Ultrasonic Sensor

An ultrasonic sensor is an instrument that measures the distance to an object using ultrasonic sound waves. An ultrasonic sensor uses a transducer to send and receive ultrasonic pulses that relay back information about an object's proximity. High-frequency sound waves reflect from boundaries to produce distinct echo patterns.

Ultrasonic sensors work by sending out a sound wave at a frequency above the range of human hearing. The transducer of the sensor acts as a microphone to receive and send the ultrasonic sound. Our ultrasonic sensors, like many others, use a single transducer to send a pulse and to receive the echo. The sensor determines the distance to a target by measuring time lapses between the sending and receiving of the ultrasonic pulse.

The working principle of this module is simple. It sends an ultrasonic pulse out at 40kHz which travels through the air and if there is an obstacle or object, it will bounce back to the sensor. By calculating the travel time and the speed of sound, the distance can be calculated.

Figure 3.1.2: Ultrasonic Sensor

Specification:

- Power Supply: 3.3V to 5V.
- Operating Current: 8mA.
- Working Frequency: 40Hz.
- Ranging Distance : 3cm – 350cm/3.5m.
- Resolution : 1 cm.
- Measuring Angle: 15 degree.
- Trigger Input Pulse width: 10uS TTL.
- Dimension: 50mm x 25mm x 16mm.

3.1.3 Motor Driver

A motor driver takes the low-current signal from the controller circuit and amps it up into a high-current signal, to correctly drive the motor. It basically controls a high-current signal using a low-current signal. There are different types of motor drivers available in the market, in the form of ICs.

L298N Motor Driver Module is a high power motor driver module for driving DC and Stepper Motors. This module consists of an L298 motor driver IC and a 78M05 5V regulator. L298N Module can control up to 4 DC motors, or 2 DC motors with directional and speed control.

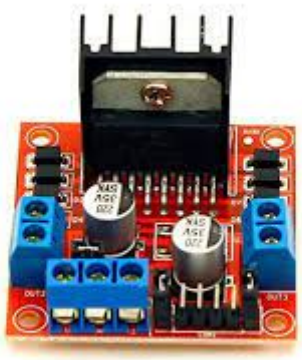


Figure 3.1.3: Motor Driver

Specification:

- Driver Chip: Double H Bridge L298N
- Motor Supply Voltage (Maximum): 46V
- Motor Supply Current (Maximum): 2A
- Drives up to 2 bidirectional DC motors
- High noise immunity inputs.
- Heatsink for better performance

3.1.4 Johnson DC Gear Motor

The Johnson geared motor is famous for its compact size and massive torque. A torque as much as x3 as compared to center shaft or side shaft geared motor. The motor comes with a metal gearbox and off centered shaft, also shaft has a metal bushing for wear resistance.

Figure 3.1.4: DC Motor

Specification:

- Operating Viltage: 6V - 18V
- Nominal Voltage: 12V
- Torque: 34.2 N-cm.
- Speed(RPM): 300
- shaft diameter - 6mm

3.1.5 Web Camera

A webcam is a video camera that feeds or streams an image or video in real time to or through a computer network, such as the Internet. Webcams are typically small cameras that sit on a desk or are built into the hardware.

Figure 3.1.5: Web Camera

Specification:

- Operating Voltage: 5V
- Video Sensor Resolution:1280x720
- Image Sensor Resolution: 720 MP
- Weight: 200 g

3.1.6 GPS Module

The Ublox NEO-M8N GPS module is a well-performing complete GPS receiver ,which provides a strong satellite search capability. With the power and signal indicators, you can monitor the status of the module. The module can save the data when the main power is shut down accidentally.

Figure 3.1.6: GPS Module

Specification:

- Operating Supply Voltage: 1.65 -3.6 Volt.
- Interface Type: I2C,SPI,UART,USB.
- Maximum Operating Temperature: +85 ℃.
- Frequency: 1.575 Ghz.

3.1.7 Lithium-Ion battery

A lithium-ion battery is a family of rechargeable battery types in which lithium ions move from the negative electrode to the positive electrode during discharge and back when charging. Lithium-ion batteries are common in consumer electronics. They are one of the most popular types of rechargeable battery for portable electronics, with one of the best energy-to-weight ratios, high open circuit voltage, low self-discharge rate, no memory effect and a slow loss of charge when not in use.

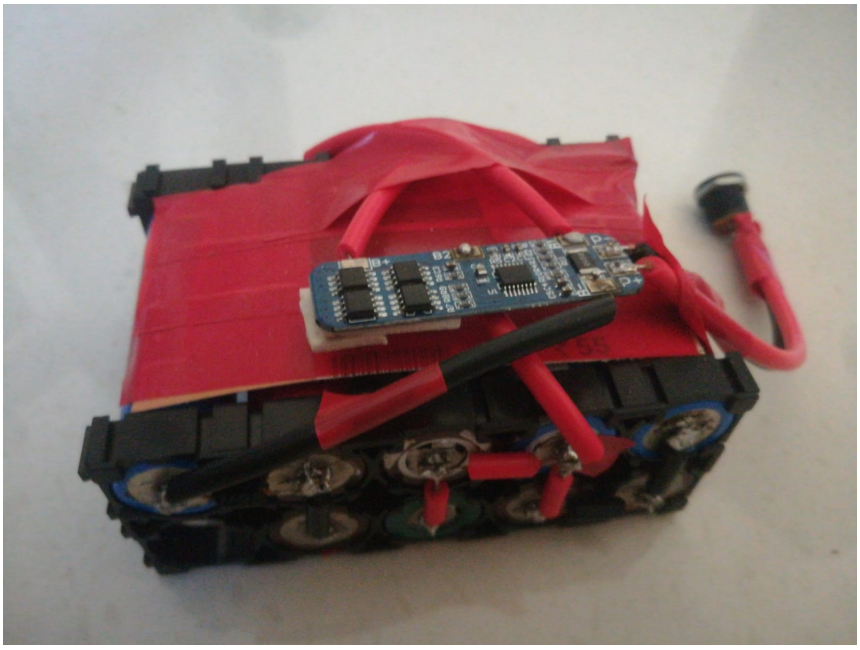


Figure 3.1.7: 12v Battery Pack

Specification:

- Voltage: 12 Volt
- Battery Typ: Lithium-Ion
- Capacity: 4000mAh

3.2 Block Diagram

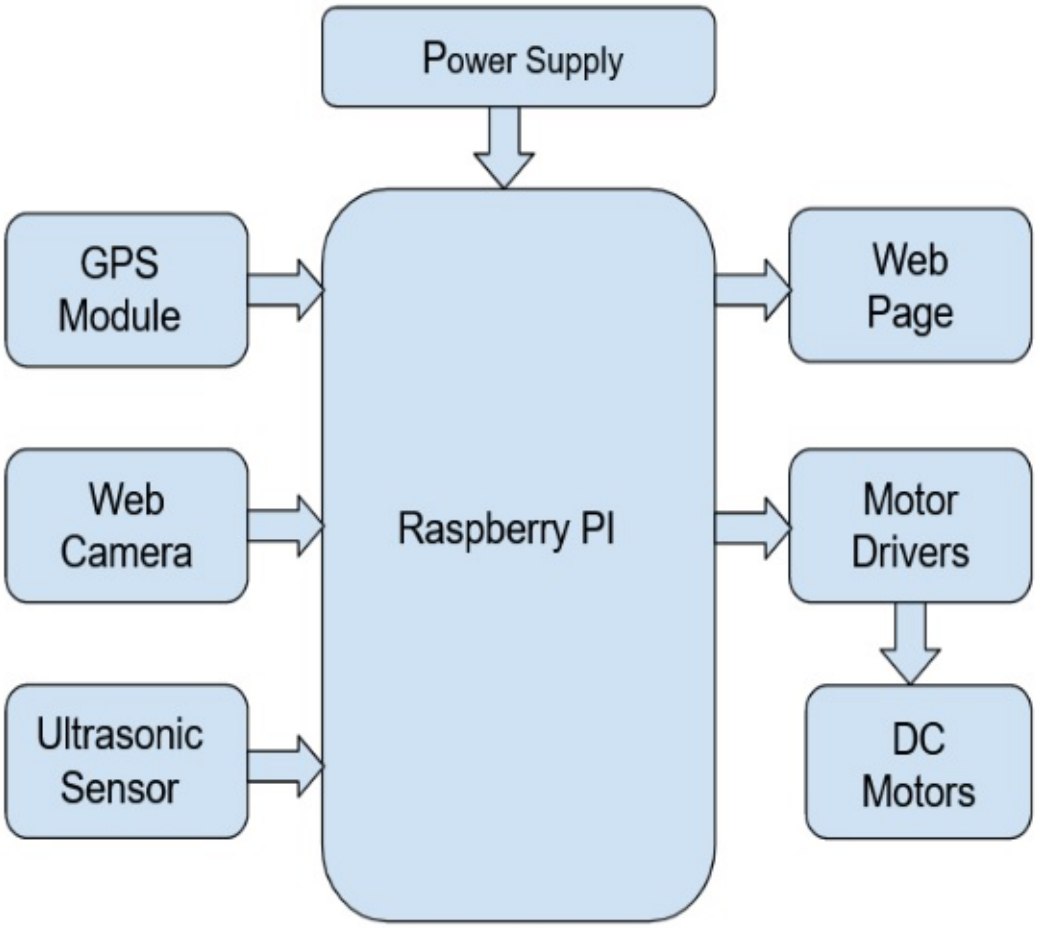


Figure 3.2.1: Block Diagram

3.2.1 Block Diagram Description

In this project we have used Raspberry pi as the controller. Here all the processing such as object detection and activation and deactivation of motors has been handled by Raspberry PI. We are using a web camera to capture the frames in real time, this frame captured by the webcam will be send to rpi. Yolo algorithm will identify if the frame contains the logo,if yes then rpi will instruct the motor to run accordingly. This project have a specific logo which is to be detected.this logo has being trained over the darknet framework .

Ultrasonic sensor playes an important role as it helps in keeping a safe distance between user and bag and also detects object if present in the path. Ultrasonic sensor that is mounted on bag ,will detect anything In its path and will give distance between bag and that object. As ultrasonic sensor connected to raspberry pi will give distance it will be computed by rpi and bag will stop following the user if the distance is less than 8 inch.

Bag's safety is an important issue to be solved so that bag is protected from being stolen or its location can be detected easily.GPS connected to rpi solves this problem by providing the coordinates of bags location,giving a map on a webpage when in need.

Working of the component without power is impossible. Therefor we are using a battery of 12.6 V ,4 Amp providing power to raspberry pi, motor driver through buck converter. For this purpose we have designed battery using lithium ion cells in 3S3P configuration.

Motor driver connected to raspberry pi gets instruction from it to operate the motors according to the position or movement of user. Motors require high current to operate which the raspberry pi is unable to provide. Motor Driver helps to solve this problem by providing sufficient current from battery.

3.3 Hardware design

3.3.1 Interfacing Of Component

Components are interfaced together and are mounted on the base of the bag.

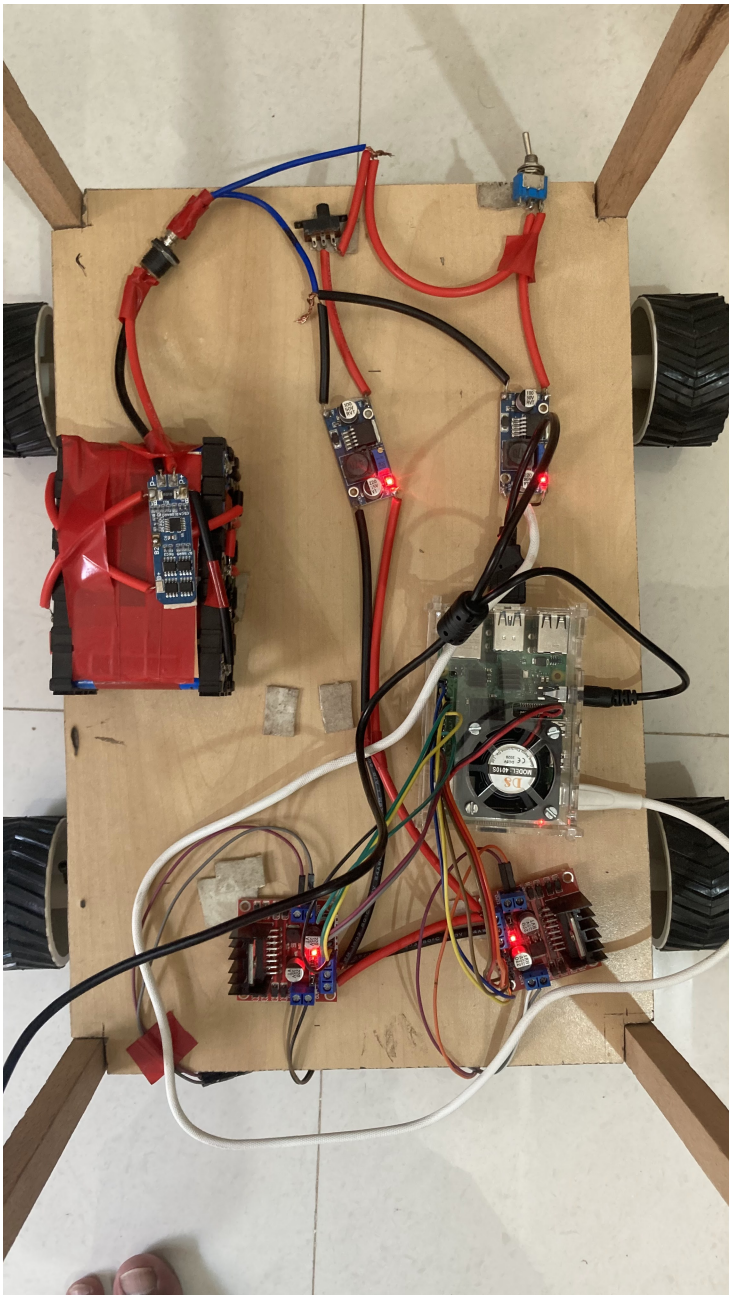


Figure 3.3.1: Interfacing Of Component

3.3.2 Front View of Bag

Here is the front view of the bag, with Camera mounted on the top to capture the logo.

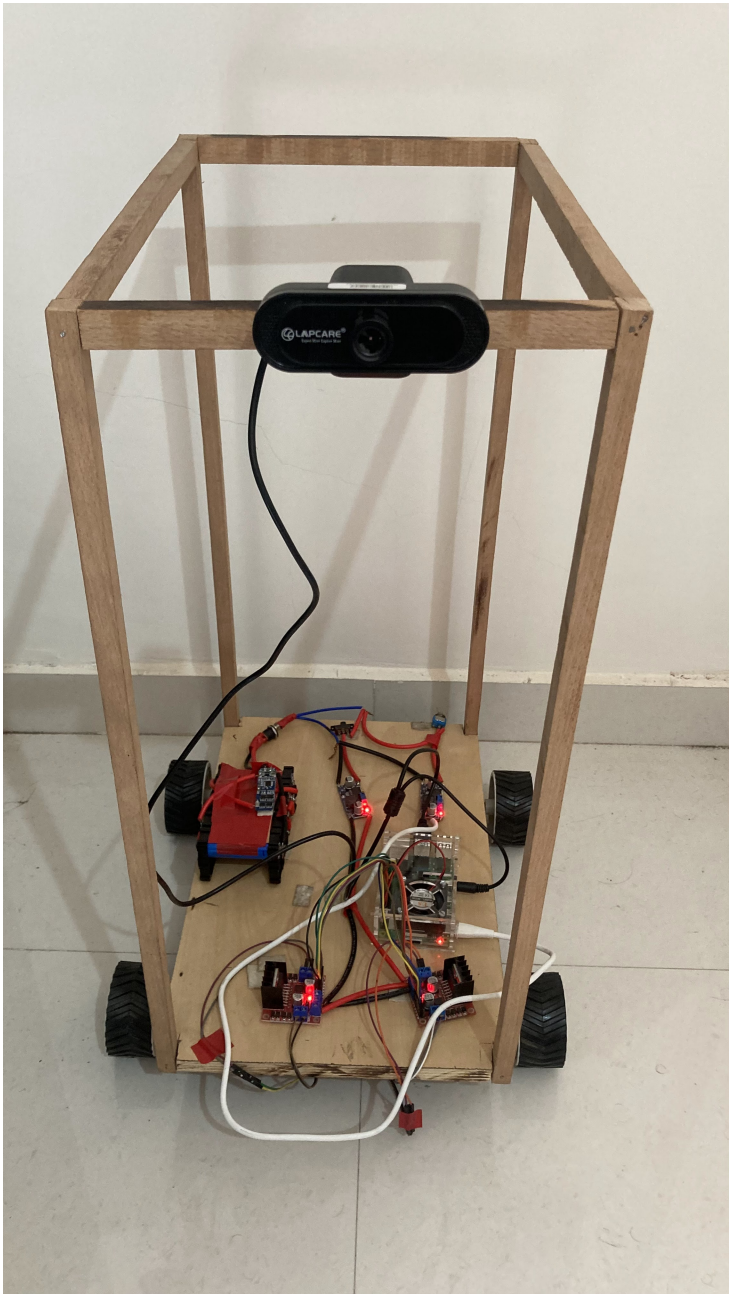


Figure 3.3.2: Front View of Bag

3.3.3 Bag Following the Onwer

Here is the prototype how the bag will follow the logo who will have logo printed on the back of the wheelchair.

Figure 3.3.3: Bag Following the Onwer

3.3.4 Bag detecting the Logo

The camera will capture the frame,if the logo is alligned, the condition is good, if the logo is partially present in the frame the bag will alligned itself with respect to the logo and if both the condition fully and partially present,are not applicable then the bag will stop.

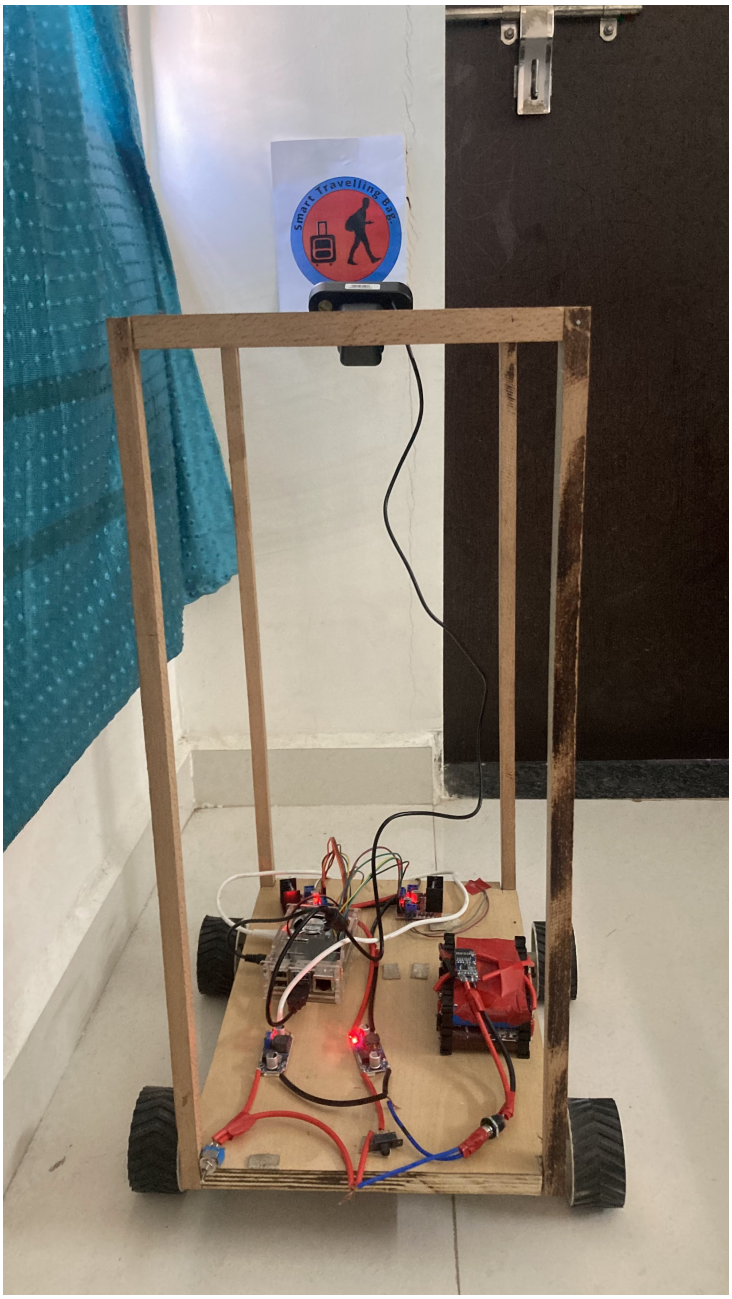


Figure 3.3.4: Bag detecting the Logo

3.4 Software Design

3.4.1 Modern Tools used

Darknet: Darknet is an open source neural network framework. It is a fast and highly accurate (accuracy for custom trained model depends on training data, epochs, batch size and some other factors) framework for real time object detection (also can be used for images). The most important reason it is fast because it is written in C and CUDA.

YOLO: YOLO is an algorithm that uses neural networks to provide real-time object detection. YOLO is an abbreviation for the term 'You Only Look Once'. This is an algorithm that detects and recognizes various objects in a picture (in real-time). YOLO algorithm employs convolutional neural networks (CNN) to detect objects in real-time. As the name suggests, the algorithm requires only a single forward propagation through a neural network to detect objects.

3.4.2 Flowchart

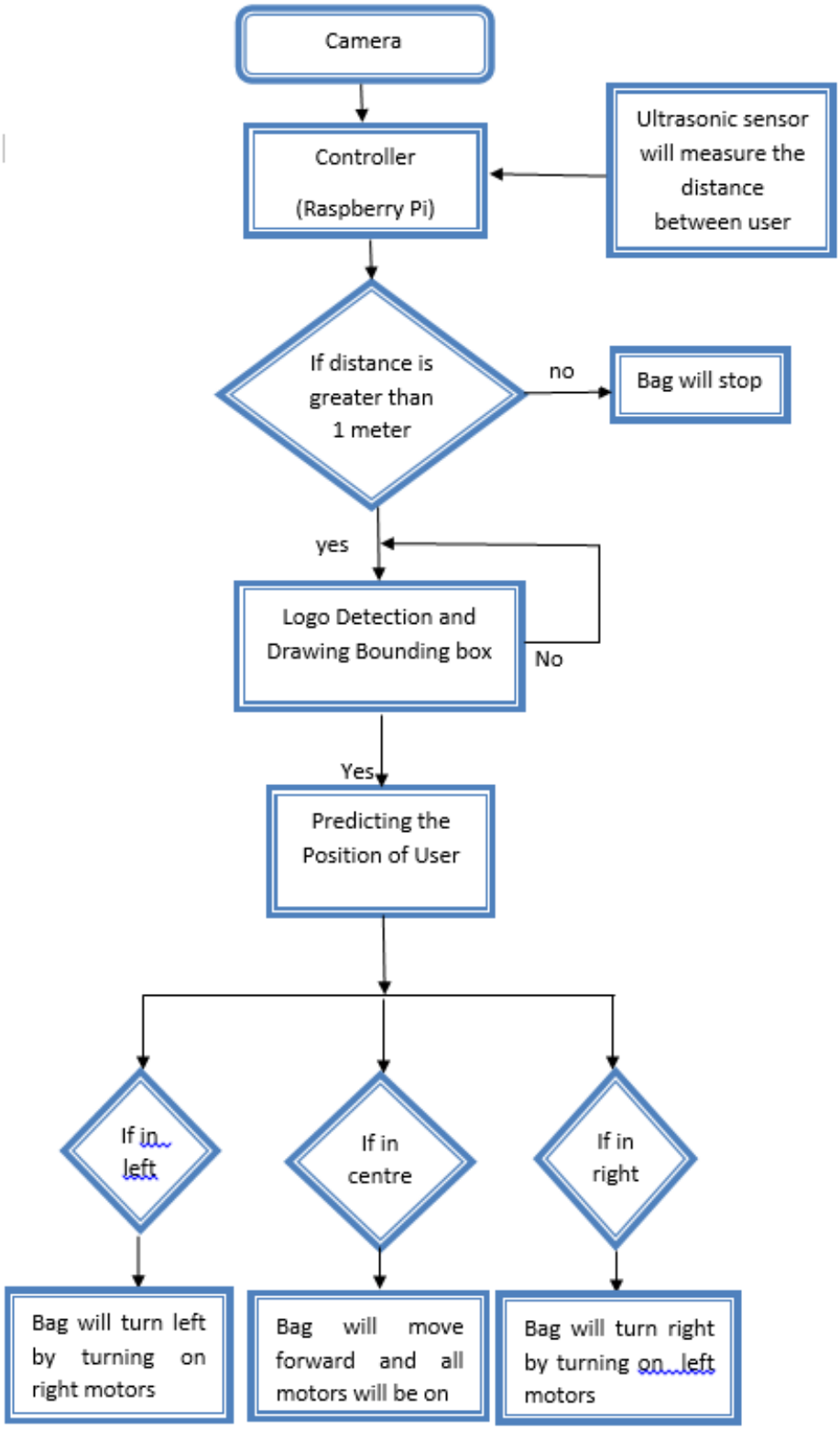


Figure 3.4.1: Flowchart

4 Working and Result

4.1 Working

The bag shown in the above image uses a unique image 'tag' to follow the correct person. For this purpose, we are using a web camera to capture real time frames i.e., to capture the video. These frames are then sent to raspberry Pi for processing and extracting appropriate information. From these captured frames Our specially trained object detection model will detect the tag and thus can detect the correct person. To detect the object, we are using YOLO algorithm which runs on opensource 'darknet' framework.

YOLO is an algorithm that uses neural networks to provide real-time object detection. YOLO is an abbreviation for the term 'You Only Look Once'. This is an algorithm that detects and recognizes various objects in a picture (in real-time). YOLO algorithm employs convolutional neural networks (CNN) to detect objects in real-time. As the name suggests, the algorithm requires only a single forward propagation through a neural network to detect objects i.e., each frame captured by camera is only processed once and does not require multiple propagations like many other popular object detection algorithms.

According to the position of the tag i.e., the user in the given frame the raspberry Pi is abele to accurately predict the position of the user i.e., where the user is located in real world. Once the location of the user is known then raspberry pi takes appropriate actions to follow the user.

To Follow the user, we are using 4 motors, according to position of the user raspberry Pi gives signal to control the motors. For controlling the motors, we are using two L298N motor Drivers. If the user is present on the left side of the frame the raspberry pi will send signal to start the right side motors thus turning the bag in left direction and if the user is present on the right side of the frame the raspberry pi will send signal to start the left side motors thus turning the bag in right direction.

Ultrasonic sensor is used to continuously sense if any objects or ob-

stacles are present in the path between the user and the bag. With the help of ultrasonic sensor, the distance between the bag and the user is also continuously calculated. If the distance between the user and the bag is less than a certain fixed value, int this case 8 inches all the motors will stop, thus stopping the movement of the bag. In this we are also able to maintain a fix distance between bag and the user. Thus, ultrasonic sensor is used to avoid any king of obstacles and maintain a fixed distance while following the path of the user.

GPS module is connected to raspberry Pi to monitor the live location the bag. This Live location will be displayed on a webpage whose URL will be provided to the user. This Provides some extra security and will be useful to locate the bag if it gets stolen or is lost.

4.2 Result

Different experiments were conducted and the performance of the human following robot was tested. Each experiment that was performed took about 5 to 10 minutes. On the basis of results obtained from these tests and experiments, we made the necessary changes in the processing and control algorithm.

First test was performed on the ultrasonic sensor. It was noted that sensor was working accurately with in a range of 4 meters. Then we performed the test to check that weather the robot maintains a specific distance with target object. Initially the we set the stopping of robot to 4 inches. It was observed that robot collided with the object as the distance between robot and target object approaches to 4 inches. This problem behind this was that the stopping distance was small enough and robot was not stopping quickly because of its load on board. So we increased the distance to 8 inches. Then we again verified the routine.

Then the next experiment was to test the detection of tag. We observed that in certain lightning conditions the tag was not detecting properly. So we adjusted the saturation. So after changing the Saturation value we observed that this time the camera was detecting the Tag properly. The next test we performed gave us the insight on battery usage and the actual required voltage needed for the motors

to reach the set speed. It was found that the battery that the battery backup was of minimum 2 hours and maximum 3.5 hours depending on the weight that the robot is carrying. It was also observed that on standby mode the battery backup lasts over 10 hours.

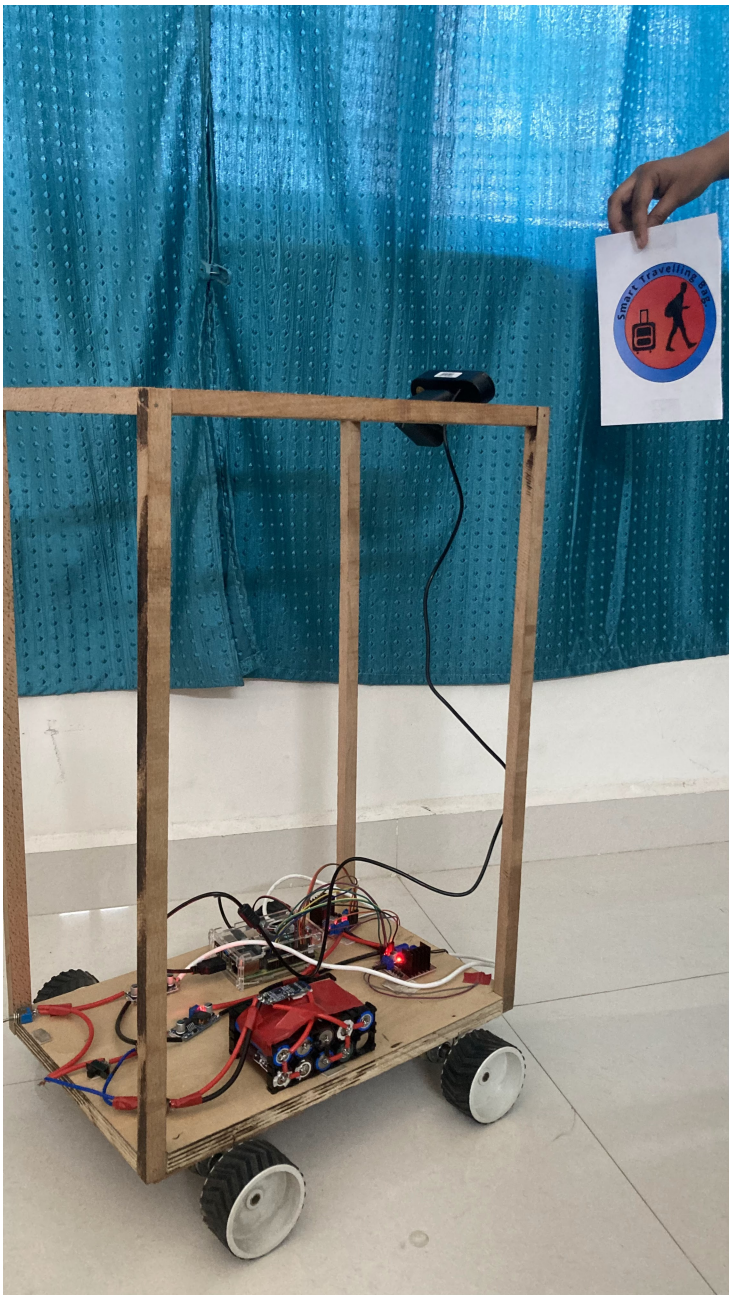


Figure 4.2.1: Bag following the logo

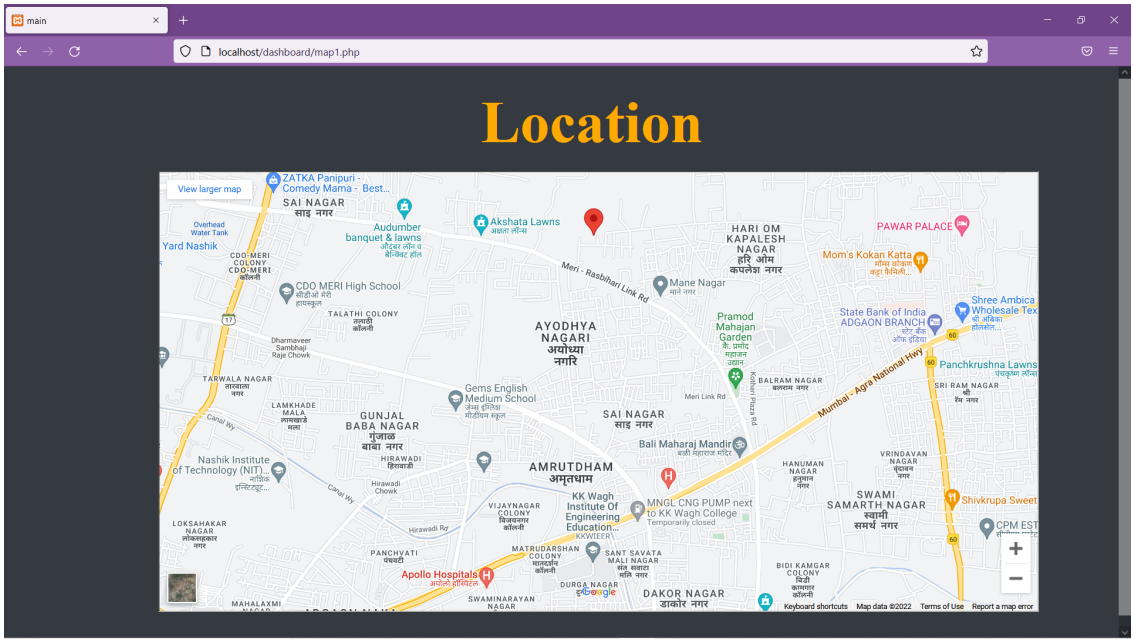


Figure 4.2.2: Location of Bag on webpage

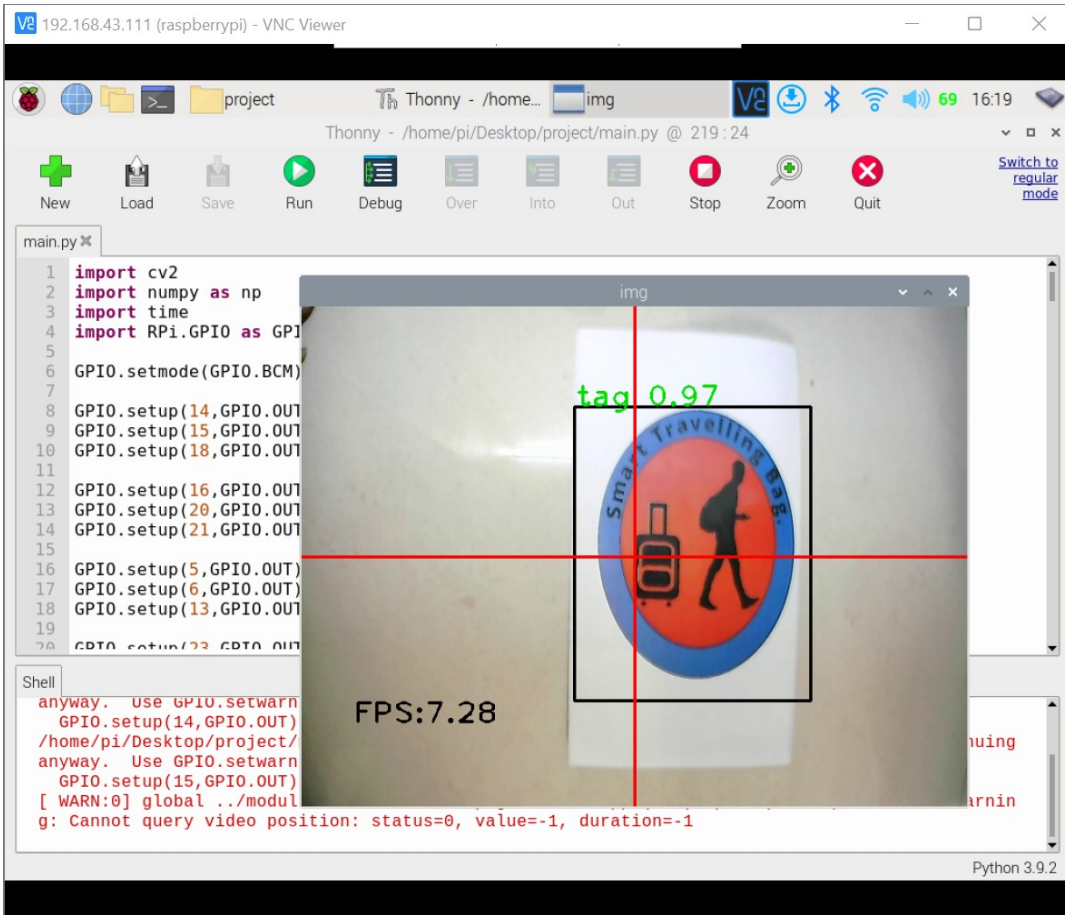


Figure 4.2.3: Logo Detection(Using YOLO Algorithm)

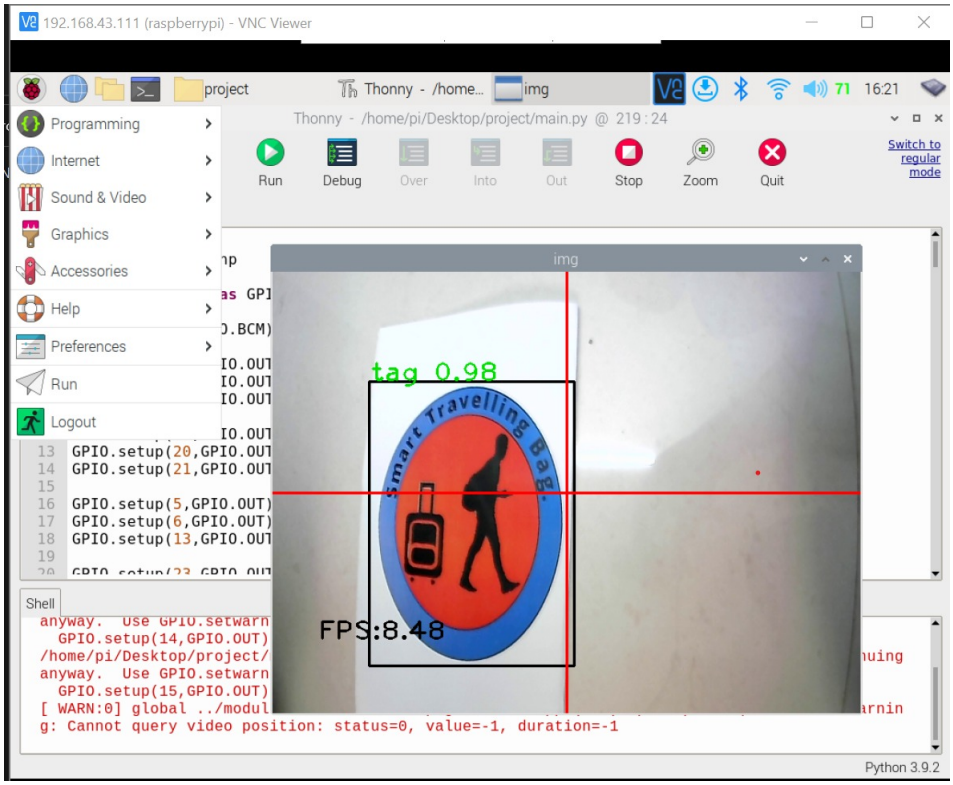


Figure 4.2.4: Logo Detection(Using YOLO Algorithm)

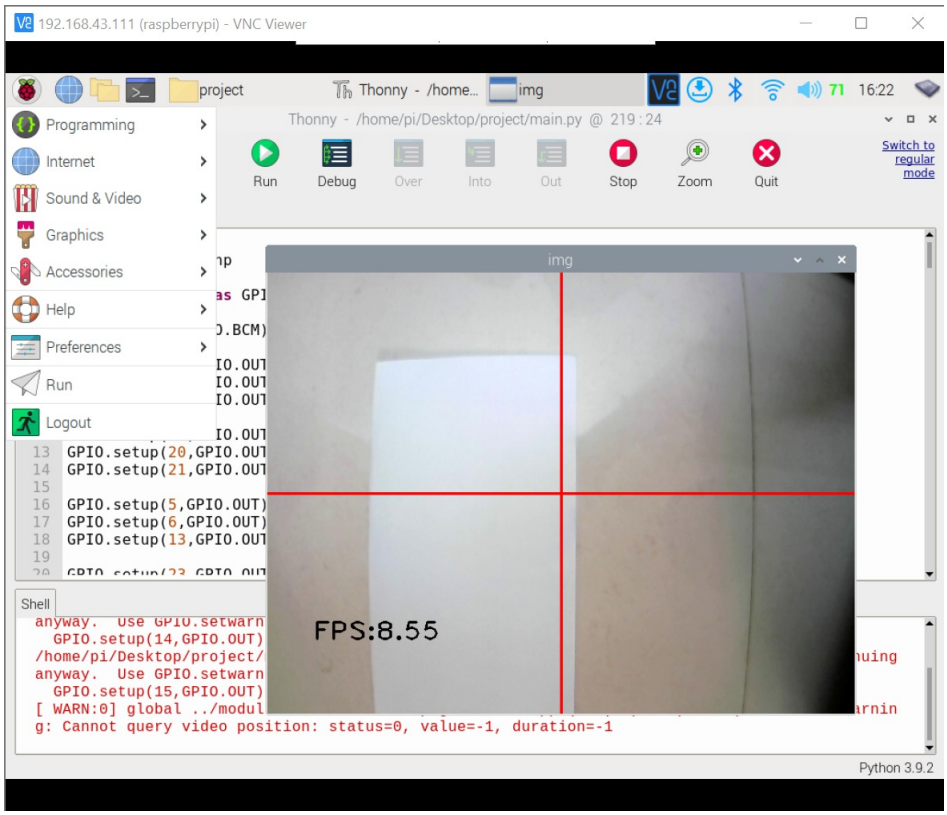


Figure 4.2.5: Logo Detection(Using YOLO Algorithm)

5 Conclusion and Furure Scope

5.1 Conclusion

- In day-to-day life when we are traveling luggage carrier is big problem. Using this technique, we can overcome this problem of carrying luggage especially for disabled people.
- Using Image processing and object detection instead of a Sensor based approach helped us to overcome some issues such as bandwidth limitations, poor GPS performance in indoor conditions, etc.

5.2 Future Scope

- Security features can be added which will increase the confidence of the user that the bag will not get stolen or is left behind.
- Finger print sensor can be added for extra security.
- Bluetooth can also be added to provide additional connectivity features that can provide user will essential data of the bag to user such as battery percentage, weigh of the bag,etc.

Reference

[1]. Design and Development of Human Following Robot 1Muhammad Sarmad Hassan, 2Mafaz Wali Khan, 3Ali Fahim Khan Department of Electrical Engineering. July 2015.

[2]. GPS and GSM Based Vehicle Tracking System Ni Ni san Hlaing Ma Naing, San San Naing. June 2019.

[3]. Design and Implementing Automatic follower bag Design and Implementing Automatic follower bag Krishn Kumar Yadav, Nitesh Tiwari , Abhishek Yadav February 17, 2020.

[4]. AUTOMATIC LUGGAGE FOLLOWER Sonali Patil1, Shrutika Patil2, Anuja Patil3, Prof. Deshmukh S. C.4 1,2,3Student, Department of Electronics And Telecommunication Engineering, Sanjay ghodawat College of Engineering, Atigre, Kolhapur.

[5]. FACE DETECTION AND RECOGNITION USING RASPBERRY PI Ishita Gupta, Varsha Patil, Shreya Kadam. December 2016, Conference: IEEE =WIECONAt: PUNE

APPENDIX A: Course Detail Sheet

Course Detail Sheet

Programme: 2015			Class: B.E(Electronics)					Sem. I&II
Course Code: 404208 & 404215			Course Project Phase-I and Project Phase-II					
Course Teacher: Project Guides			Department: Electronics and Telecommunication Engineering					
Teaching Scheme			Examination Scheme					
Theory	Practical	Tutorial	Theory			Lab		
(hrs/ week)	(hrs/ week)	(hrs/ week)	~~Online~~/ Insem	Endsem	Sessional	Term Work	Practical	Oral
----	----	2+6 hrs	---	---	---	150	---	50+50

Abstract: By learning this subject students will be able to Identify complex problem and define the methodology to solve the problem. Construct, analyze and approach problem solution as a team, plan, and co-ordinate and control the complex and diverse activities in project. Design appropriately using a modular construction approach to solve the problem as per specifications and implement the selected methodology to solve the problem by selecting the correct hardware according to specifications and software for simulation and programming and develop leadership skills by aligning with the objective of the project and lead the team towards its goal

Prerequisite: All Subjects of Electronics Engineering

Delivery Methods (DM)

Chalk & Talk	ICT Tools	Group Discussion	Industrial/ Field Visit	Expert Talk	Survey	Mini project	Lab
--	√	--	--	--	√	--	--

Course Outcomes (COs)

Course Outcome	After successful completion of course students will be able to
CO404208.1& CO404215.1	Define, analyze and solve complex real life problem.
CO404208.2& CO404215.2	Work in collaborative team as a member or leader.
CO404208.3& CO404215.3	Apply project management techniques.
CO404208.4& CO404215.4	Identify and apply appropriate tools.
CO404208.5& CO404215.5	Communicate effectively in verbal and written form.
CO404208.6& CO404215.6	Imbibe ethical practices.

Learning objective for CO1 **Students will be able to:**	
1	Identify specification of the problem.
2	Structure the problem.
3	Identify the appropriate methodology to solve the problem.
4	Define the methodology to solve the problem.
Learning objective for CO2 **Students will be able to:**	
1	Adapt the vital skills of compromise and collaboration.
2	Construct , analyzes and approach problem solution as a team
3	Fully understand the role of each individual in a group to accomplish the goal.
4	Develop leadership skills by aligning with the objective of the project and lead the team towards its goal.
Learning objective for CO3 **Students will be able to**	
1	Plan, co-ordinate and control the complex and diverse activities in project
2	Predict any problems and find solution for it
3	Plan the progress to result in total completion of the project.
Learning objective for CO4 **Students will be able to**	
1	Design appropriately using a modular construction approach to solve the problem as per specifications.
2	Implement the selected methodology to solve the problem.
3	Select the correct hardware according to specifications.
4	Select the correct software for simulation and programming.
5	Validate the result and draw conclusion.
Learning objective for CO5 **Students will be able to**	
1	Present the work done by proper documentation
2	Present paper in national / international conferences, project exhibitions & competitions
Learning objective for CO6 **Students will**	
1	Develop professional practice.
2	Recognize how *to do the project to its best*.
3	Develop ethical Practices.

Mapping of Course Objectives to Course Outcomes:

Course Objective	Course Outcomes					
	1.	2.	3.	4.	5.	6.
C-I	•					
C-II		•				
C-III			•			
C-IV				•		
C-V					•	
C-VI						•

Program Outcomes (POs):

Engineering Graduates will be able to:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSO):

1. Analyze and design electronic systems for hybrid engineering application.
2. Implement functional blocks of hardware, software or hardware-software co-design for electronics applications.

Mapping of Course Outcome (CO) with
Program Outcome (PO) and Program Specific Outcome (PSO)
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)
If there is no correlation, put "-"

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO404208.1 & CO404215.1	3	3	3	3	-	2	-	-	-	-	-	-	3	3
CO404208.2 & CO404215.2	-	-	-	-	-	-	-	-	3	-	2	-	2	2
CO404208.3 & CO404215.3	-	-	-	-	-	-	-	-	-	-	3	2	-	-
CO404208.4 & CO404215.4	2	2	-	3	3	-	-	-	-	-	-	2	-	-
CO404208.5 & CO404215.5	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO404208.6 & CO404215.6	-	-	-	-	-	-	-	3	-	-	-	-	-	-
Average	2.5	2.5	3	3	3	2	-	3	3	3	2.5	2	2.5	2.5

Course-PO matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
404208 & 404215	2.5	2.5	3	3	3	2	-	3	3	3	2.5	2	2.5	2.5

APPENDIX B: Circuit Schematic

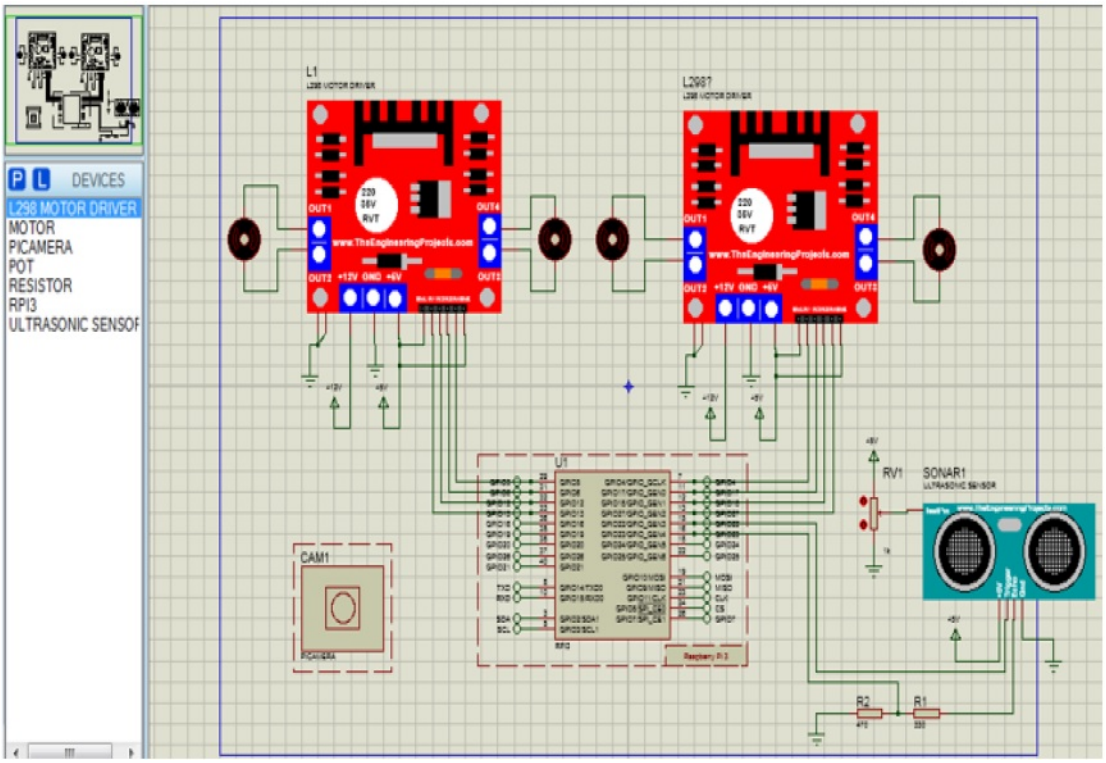


Figure 5.2.1: Circuit Schematic

APPENDIX C: Bill of Material

Sr. No:	**Components**	**Cost**
1	Raspberry Pi 4b	4200/-
2	DC Motors (4 Quantity)	1524/-
3	Motor Driver	200
4	Battery	1300/-
5	Wheels	200/-
6	Web Camera	900/-
	Total	**8324/-**

APPENDIX D: Certificate of Paper Presentation/ Project Competition.

Guru Gobind Singh Foundation

Guru Gobind Singh Polytechnic

Appreciation Certificate

This certificate is awarded to Atharva Aserkar.

has Participated/Secured ___ in "District Level Project Competition"

Celebrating 75 th year of Independence in association with DTE, RO Nashik.

on 9th March 2022

organized by

Guru Gobind Singh Polytechnic, Nashik

(Accredited by National Board of Accreditation 2012-2015, 2017-2020, 2021-2023)

Prof. Shrihari Upasani, Principal, GGSP, Nashik

DR. PERMINDUR SINGH, Executive Director, GGSF, Nashik

Dr. Dnyandeo Nathe, Joint Director, Technical Education, Regional Office, Nashik

Guru Gobind Singh Foundation

Guru Gobind Singh Polytechnic

Appreciation Certificate

This certificate is awarded to Giriraj Alone.

has Participated/~~Secured~~ ___ in "District Level Project Competition"

Celebrating 75 th year of Independence in association with DTE, RO Nashik.

on 9th March 2022

organized by

Guru Gobind Singh Polytechnic, Nashik

(Accredited by National Board of Accreditation 2012-2015, 2017-2020, 2021-2023)

Prof. Shrihari Upasani, Principal, GGSP, Nashik

DR. PERMINDUR SINGH, Executive Director, GGSF, Nashik

Dr. Dnyandeo Nathe, Joint Director, Technical Education, Regional Office, Nashik

स्वातंत्र्याचा अमृत महोत्सव

In Associate With

Organized by

Guru Gobind Singh Foundation

Guru Gobind Singh Polytechnic

Appreciation Certificate

This certificate is awarded to Shraya Mishra.

has Participated/~~Secured~~ — in **"District Level Project Competition"**

Celebrating 75 th year of Independence **in association with DTE, RO** Nashik.

on 9th March 2022

organized by

Guru Gobind Singh Polytechnic, Nashik

(Accredited by National Board of Accreditation 2012-2015, 2017-2020, 2021-2023)

Prof. Shrihari Upasani
Principal
GGSP, Nashik

DR. PERMINDUR SINGH
Executive Director
GGSF, Nashik

~~Dr. Dnyandeo Nathe~~
Joint Director,
Technical Education, Regional Office, Nashik

Scanned with CamScanner

APPENDIX E: Report for Plagiarism Check.

Plagiarism Certificate

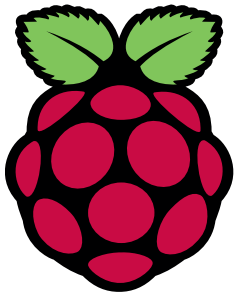
This is to certify that the project work titled "SMART TRAVELLING BAG FOR DISABLED PEOPLE", is a part of project work carried out by "Giriraj Alone, Atharva Aserkar, Shravya mishra" under the guidance of Prof P.P.Patil at K. K. Wagh Institute of Engineering Education and Research, Nashik, in the partial fulfillment of the requirements for Bachelor's degree in Electronics and Telecommunication Engineering.

To the best of our knowledge, the work included in this report is an original work carried out by us independently. The percentage of plagiarism is ..... . The results of the project work in part or whole have not been submitted to any other Institute/University for the award of any degree.

GIRIRAJ ALONE
ATHARVA ASERKAR
SHRAVYA MISHRA

APPENDIX F: Data Sheets

DATASHEET



Raspberry Pi 4 Model B

Release 1

June 2019

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1 Introduction

The Raspberry Pi 4 Model B (Pi4B) is the first of a new generation of Raspberry Pi computers supporting more RAM and with siginficantly enhanced CPU, GPU and I/O performance; all within a similar form factor, power envelope and cost as the previous generation Raspberry Pi 3B+.

The Pi4B is avaiable with either 1, 2 and 4 Gigabytes of LPDDR4 SDRAM.

2 Features

2.1 Hardware

- Quad core 64-bit ARM-Cortex A72 running at 1.5GHz
- 1, 2 and 4 Gigabyte LPDDR4 RAM options
- H.265 (HEVC) hardware decode (up to 4Kp60)
- H.264 hardware decode (up to 1080p60)
- VideoCore VI 3D Graphics
- Supports dual HDMI display output up to 4Kp60

2.2 Interfaces

- 802.11 b/g/n/ac Wireless LAN
- Bluetooth 5.0 with BLE
- 1x SD Card
- 2x micro-HDMI ports supporting dual displays up to 4Kp60 resolution
- 2x USB2 ports
- 2x USB3 ports
- 1x Gigabit Ethernet port (supports PoE with add-on PoE HAT)
- 1x Raspberry Pi camera port (2-lane MIPI CSI)
- 1x Raspberry Pi display port (2-lane MIPI DSI)
- 28x user GPIO supporting various interface options:
  - Up to 6x UART
  - Up to 6x I2C
  - Up to 5x SPI
  - 1x SDIO interface
  - 1x DPI (Parallel RGB Display)
  - 1x PCM
  - Up to 2x PWM channels
  - Up to 3x GPCLK outputs

2.3 Software

- ARMv8 Instruction Set
- Mature Linux software stack
- Actively developed and maintained
  - Recent Linux kernel support
  - Many drivers upstreamed
  - Stable and well supported userland
  - Availability of GPU functions using standard APIs

3 Mechanical Specification

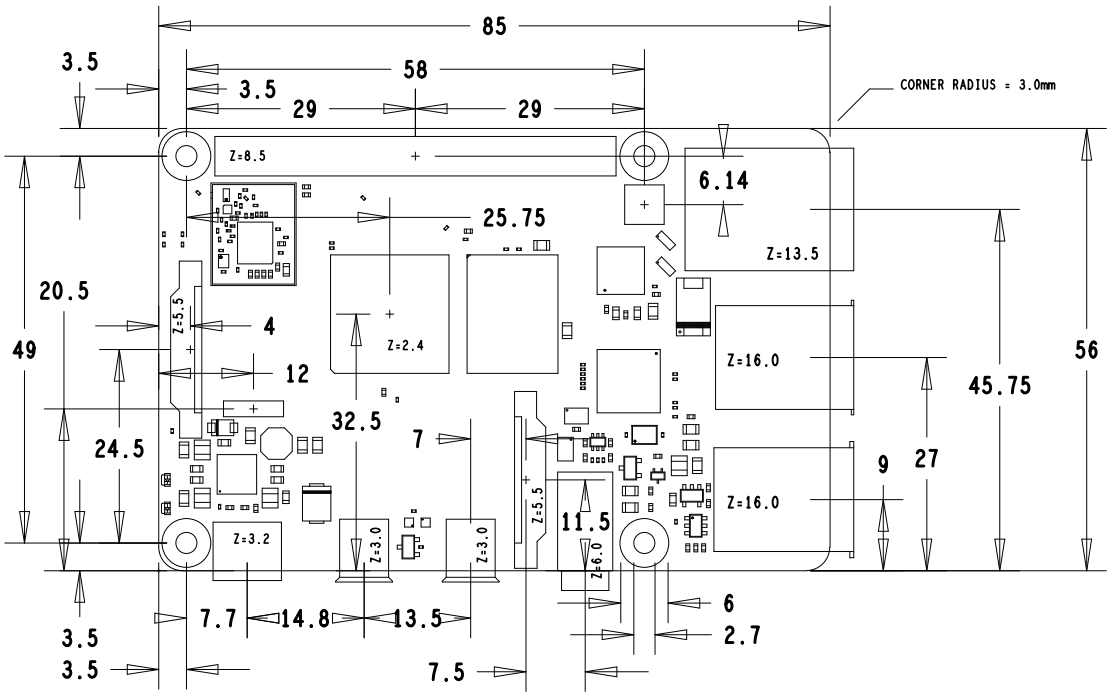

Figure 1: Mechanical Dimensions

4 Electrical Specification

Caution! Stresses above those listed in Table 2 may cause permanent damage to the device. This is a stress rating only; functional operation of the device under these or any other conditions above those listed in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Symbol	Parameter	Minimum	Maximum	Unit
VIN	5V Input Voltage	-0.5	6.0	V

Table 2: Absolute Maximum Ratings

Please note that VDD_IO is the GPIO bank voltage which is tied to the on-board 3.3V supply rail.

Symbol	Parameter	Conditions	Minimum	Typical	Maximum	Unit
V_{IL}	Input low voltage[a]	VDD_IO = 3.3V	-	-	TBD	V
V_{IH}	Input high voltage[a]	VDD_IO = 3.3V	TBD	-	-	V
I_{IL}	Input leakage current	TA = +85°C	-	-	TBD	μA
C_{IN}	Input capacitance	-	-	TBD	-	pF
V_{OL}	Output low voltage[b]	VDD_IO = 3.3V, IOL = -2mA	-	-	TBD	V
V_{OH}	Output high voltage[b]	VDD_IO = 3.3V, IOH = 2mA	TBD	-	-	V
I_{OL}	Output low current[c]	VDD_IO = 3.3V, VO = 0.4V	TBD	-	-	mA
I_{OH}	Output high current[c]	VDD_IO = 3.3V, VO = 2.3V	TBD	-	-	mA
R_{PU}	Pullup resistor	-	TBD	-	TBD	kΩ
R_{PD}	Pulldown resistor	-	TBD	-	TBD	kΩ

[a] Hysteresis enabled
[b] Default drive strength (8mA)
[c] Maximum drive strength (16mA)

Table 3: DC Characteristics

Pin Name	Symbol	Parameter	Minimum	Typical	Maximum	Unit
Digital outputs	t_{rise}	10-90% rise time[a]	-	TBD	-	ns
Digital outputs	t_{fall}	90-10% fall time[a]	-	TBD	-	ns

[a] Default drive strength, CL = 5pF, VDD_IO = 3.3V

Table 4: Digital I/O Pin AC Characteristics

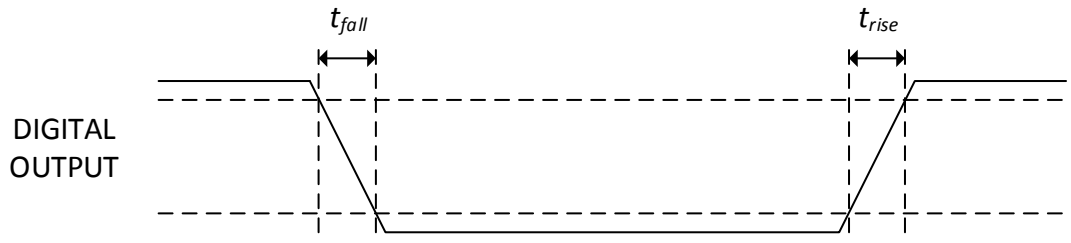

Figure 2: Digital IO Characteristics

4.1 Power Requirements

The Pi4B requires a good quality USB-C power supply capable of delivering 5V at 3A. If attached downstream USB devices consume less than 500mA, a 5V, 2.5A supply may be used.

5 Peripherals

5.1 GPIO Interface

The Pi4B makes 28 BCM2711 GPIOs available via a standard Raspberry Pi 40-pin header. This header is backwards compatible with all previous Raspberry Pi boards with a 40-way header.

5.1.1 GPIO Pin Assignments

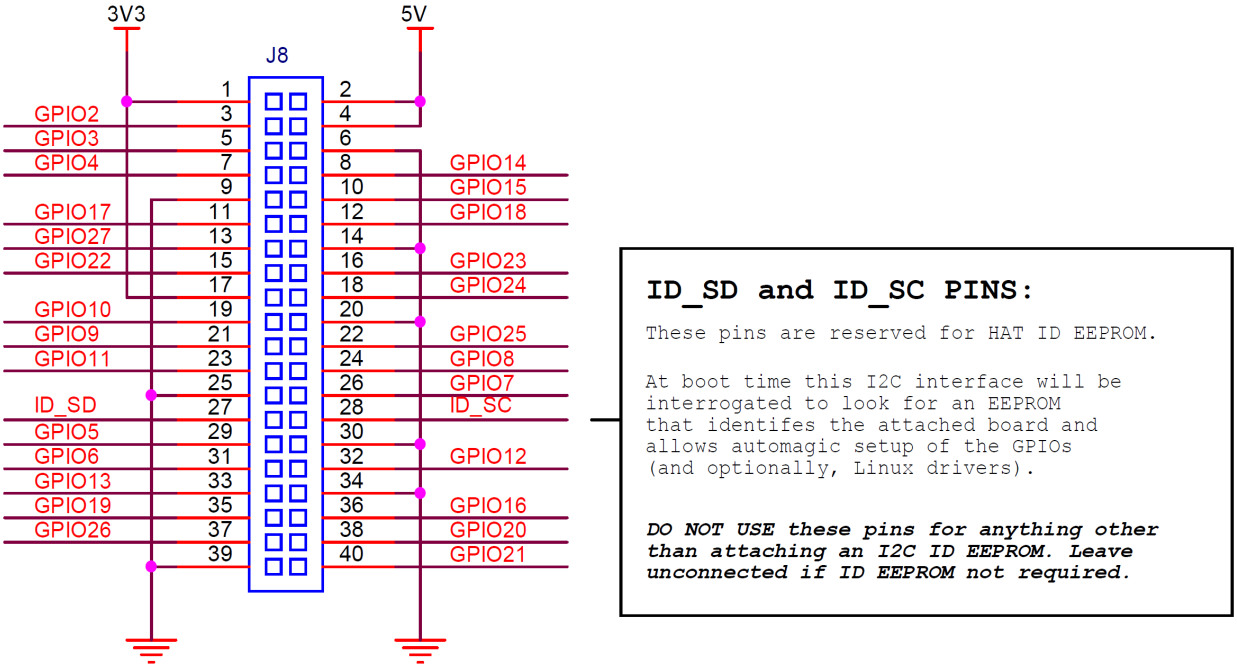

Figure 3: GPIO Connector Pinout

As well as being able to be used as straightforward software controlled input and output (with programmable pulls), GPIO pins can be switched (multiplexed) into various other modes backed by dedicated peripheral blocks such as I2C, UART and SPI.

In addition to the standard peripheral options found on legacy Pis, extra I2C, UART and SPI peripherals have been added to the BCM2711 chip and are available as further mux options on the Pi4. This gives users much more flexibility when attaching add-on hardware as compared to older models.

5.1.2 GPIO Alternate Functions

GPIO	Default Pull	ALT0	ALT1	ALT2	ALT3	ALT4	ALT5
0	High	SDA0	SA5	PCLK	SPI3_CE0_N	TXD2	SDA6
1	High	SCL0	SA4	DE	SPI3_MISO	RXD2	SCL6
2	High	SDA1	SA3	LCD_VSYNC	SPI3_MOSI	CTS2	SDA3
3	High	SCL1	SA2	LCD_HSYNC	SPI3_SCLK	RTS2	SCL3
4	High	GPCLK0	SA1	DPI_D0	SPI4_CE0_N	TXD3	SDA3
5	High	GPCLK1	SA0	DPI_D1	SPI4_MISO	RXD3	SCL3
6	High	GPCLK2	SOE_N	DPI_D2	SPI4_MOSI	CTS3	SDA4
7	High	SPI0_CE1_N	SWE_N	DPI_D3	SPI4_SCLK	RTS3	SCL4
8	High	SPI0_CE0_N	SD0	DPI_D4	-	TXD4	SDA4
9	Low	SPI0_MISO	SD1	DPI_D5	-	RXD4	SCL4
10	Low	SPI0_MOSI	SD2	DPI_D6	-	CTS4	SDA5
11	Low	SPI0_SCLK	SD3	DPI_D7	-	RTS4	SCL5
12	Low	PWM0	SD4	DPI_D8	SPI5_CE0_N	TXD5	SDA5
13	Low	PWM1	SD5	DPI_D9	SPI5_MISO	RXD5	SCL5
14	Low	TXD0	SD6	DPI_D10	SPI5_MOSI	CTS5	TXD1
15	Low	RXD0	SD7	DPI_D11	SPI5_SCLK	RTS5	RXD1
16	Low	FL0	SD8	DPI_D12	CTS0	SPI1_CE2_N	CTS1
17	Low	FL1	SD9	DPI_D13	RTS0	SPI1_CE1_N	RTS1
18	Low	PCM_CLK	SD10	DPI_D14	SPI6_CE0_N	SPI1_CE0_N	PWM0
19	Low	PCM_FS	SD11	DPI_D15	SPI6_MISO	SPI1_MISO	PWM1
20	Low	PCM_DIN	SD12	DPI_D16	SPI6_MOSI	SPI1_MOSI	GPCLK0
21	Low	PCM_DOUT	SD13	DPI_D17	SPI6_SCLK	SPI1_SCLK	GPCLK1
22	Low	SD0_CLK	SD14	DPI_D18	SD1_CLK	ARM_TRST	SDA6
23	Low	SD0_CMD	SD15	DPI_D19	SD1_CMD	ARM_RTCK	SCL6
24	Low	SD0_DAT0	SD16	DPI_D20	SD1_DAT0	ARM_TDO	SPI3_CE1_N
25	Low	SD0_DAT1	SD17	DPI_D21	SD1_DAT1	ARM_TCK	SPI4_CE1_N
26	Low	SD0_DAT2	TE0	DPI_D22	SD1_DAT2	ARM_TDI	SPI5_CE1_N
27	Low	SD0_DAT3	TE1	DPI_D23	SD1_DAT3	ARM_TMS	SPI6_CE1_N

Table 5: Raspberry Pi 4 GPIO Alternate Functions

Table 5 details the default pin pull state and available alternate GPIO functions. Most of these alternate peripheral functions are described in detail in the BCM2711 Peripherals Specification document which can be downloaded from the hardware documentation section of the website.

5.1.3 Display Parallel Interface (DPI)

A standard parallel RGB (DPI) interface is available the GPIOs. This up-to-24-bit parallel interface can support a secondary display.

5.1.4 SD/SDIO Interface

The Pi4B has a dedicated SD card socket which suports 1.8V, DDR50 mode (at a peak bandwidth of 50 Megabytes / sec). In addition, a legacy SDIO interface is available on the GPIO pins.

5.2 Camera and Display Interfaces

The Pi4B has 1x Raspberry Pi 2-lane MIPI CSI Camera and 1x Raspberry Pi 2-lane MIPI DSI Display connector. These connectors are backwards compatible with legacy Raspberry Pi boards, and support all of the available Raspberry Pi camera and display peripherals.

5.3 USB

The Pi4B has 2x USB2 and 2x USB3 type-A sockets. Downstream USB current is limited to approximately 1.1A in aggregate over the four sockets.

5.4 HDMI

The Pi4B has 2x micro-HDMI ports, both of which support CEC and HDMI 2.0 with resolutions up to 4Kp60.

5.5 Audio and Composite (TV Out)

The Pi4B supports near-CD-quality analogue audio output and composite TV-output via a 4-ring TRS 'A/V' jack.

The analog audio output can drive 32 Ohm headphones directly.

5.6 Temperature Range and Thermals

The recommended ambient operating temperature range is 0 to 50 degrees Celcius.

To reduce thermal output when idling or under light load, the Pi4B reduces the CPU clock speed and voltage. During heavier load the speed and voltage (and hence thermal output) are increased. The internal governor will throttle back both the CPU speed and voltage to make sure the CPU temperature never exceeds 85 degrees C.

The Pi4B will operate perfectly well without any extra cooling and is designed for sprint performance - expecting a light use case on average and ramping up the CPU speed when needed (e.g. when loading a webpage). If a user wishes to load the system continually or operate it at a high termperature at full performance, further cooling may be needed.

6 Availability

Raspberry Pi guarantee availability Pi4B until at least January 2026.

7 Support

For support please see the hardware documentation section of the Raspberry Pi website and post questions to the Raspberry Pi forum.

APPENDIX G: Rubrics for Project Phase-I and Phase-II

Rubrics

Rubrics for Project Phase-I

Maximum Marks: 50

Review-I

Sr.No.	Criterion	**Excellent**	**Good**	**Beginner**
1	Problem Definition (5)	Problem Statement clearly defined. (5-4)	Problem Statement partially defined. (4-2)	Problem Statement not defined. (2-0)
2	Scope & Objectives (10)	Description of scope of project is clearly stated and objective of project is clear (10-8)	Description of scope of project is somewhat clearly stated and objective is somewhat clear (8-5)	Scope and Objective of project is not clear (5-0)
3	Literature Review (10)	Many and relevant IEEE paper refereed. Comprehensive review providing a good basis for the project. Entire Coverage with relevant and accurate support. (10-8)	Few and relevant Papers Referred but not IEEE. Systematic survey attempted but incomplete and inconsistent. Little coverage and less accurate support. (8-5)	Very few and no relevant papers referred. No evidence of research been conducted. (5-0)
4	Methodology (10)	Methodologies which will be used are clearly described. (10-8)	Methodology which will be used are partially described (8-5)	Methodology are not described (5-0)
5	Block Diagram / Architecture (10)	Block Diagram and Design is Correct. (10-8)	Block Diagram and Design is partially Correct (8-5)	Block Diagram and Design is incorrect (5-0)
6	Project Planning (5)	Highly effective use of available resources. Effective management of workload (5-4)	Moderate use of available resources. Less effective management of workload (4-2)	No use of available resources No management of workload. (2-0)
	Total (50)	(50-40)	(40-27)	(25-0)

Rubrics

Rubrics for Project Phase-I

Maximum Marks: 50

Review-II

Sr.No.	Criterion	**Excellent**	**Good**	**Beginner**
1	Requirement Specification (10)	Properly stated and correct Specification (10-8)	Not clearly stated and incorrect Specification (8-5)	Not Properly stated and incorrect Specification (5-0)
2	Literature Review (5)	Additional improvement in the Literature Review (5-4)	Less improvement in the Literature Review (4-2)	No improvement in the Literature Review (2-0)
3	Detailed Design (10)	Designing is stated correctly (10-8)	Design is partially correct (8-5)	Designing is not correct (5-0)
4	Experimental Setup / Simulation (10)	Proper simulation and correct Experimental Setup (10-8)	Simulation and Experimental Setup is partially correct (8-5)	Simulation and Experimental Setup is not done. (5-0)
5	Performance Parameters (10)	Performance Parameters are stated clearly. (10-8)	Performance Parameters partially stated. (8-5)	Performance Parameters not stated. (5-0)
6	Efficiency Issues (5)	Efficiency Issues addressed. (5-4)	Efficiency Issues partially addressed. (4-2)	Efficiency Issues not addressed. (2-0)
	Total (50)	(50-40)	(40-27)	(25-0)

Rubrics

Rubrics for Project Phase-I

Maximum Marks: 50

Stage-I Documentation

Sr.No.	Criterion for (Project Stage-I)	**Excellent**	**Good**	**Beginner**
1	Documentation (50)	All Contents are covered with the given format and well organized report. (50-40)	Content are covered but the format is not proper and somewhat organized report. (40-20)	Content are not covered, format is not proper and report not organized. (<20)

Sr.No.	Criterion
1	Project Review 1 (50)
2	Project Review 2 (50)
3	Documentation (Project Stage-I Report) (50)
	Average of Review-1, Review-2 and Documentation stage is taken for 50 marks Evaluation

Rubrics

Rubrics for Project Phase-II

Maximum Marks: 150

Review –III

Sr.No.	Criterion	**Excellent**	**Good**	**Beginner**
1	Revised Final Design (10)	Final Design is correct (10-8)	Final Design is somewhat correct (8-5)	Design is incorrect, to be revised again (5-0)
2	Tools and Techniques Used (10)	Appropriate tools and techniques used(10-8)	Tools and techniques to some extent only used (8-5)	Tools and techniques not used(5-0)
3	Partial Implementation (15)	Project is partially implemented (15-12)	Project implementation is just started. (12-7)	Project implementation is not yet started. (7-0)
4	Partial Results (15)	Partial Results are correct. (15-12)	Partial results are somewhat correct. (12-8)	Results not obtained. (8-0)
	Total (50)	(50-40)	(40-25)	(25-0)

Review –IV

Sr.No.	Criterion	**Excellent**	**Good**	**Beginner**
1	Implementation Status (10)	Project implementation is complete. (10-8)	Project implementation is partially completed. (8-5)	Project implementation is incomplete. (5-0)
2	Modular Testing (10)	Modular testing is correct (10-8)	Modular testing is somewhat correct(8-5)	Modular testing is incorrect. (5-0)
3	Intermediate Results (15)	Desired results are shown (15-12)	Results are partially shown. (12-8)	Results are not obtained. (8-0)
4	Conclusion and Future Scope (10)	Conclusion and future scope are clearly stated (10-8)	Conclusion and future scope are somewhat clearly stated (8-5)	Conclusion and future scope are not clear. (5-0)
5	Cost Analysis (5)	Cost analysis is correct. (5-4)	Cost analysis is somewhat done (4-2)	Cost analysis not done.(2-0)
	Total (50)	(50-40)	(40-25)	(25-0)

Rubrics

Rubrics for Project Phase-II

Maximum Marks: 150

Stage-II Documentation

Sr.No.	Criterion for (Project Stage-II)	**Excellent**	**Good**	**Poor**
1	Documentation (50)	All Contents are covered with the given format and well organized report. (50- 40)	Content are covered but the format is not proper and somewhat organized report. (40-20)	Content are not covered, format is not proper and report not organized. (<20)

Sr.No.	Criterion
1	Project Review 3 (50)
2	Project Review 4 (50)
3	Documentation (Project Stage-II Report) (50)
	Total of Review-3, Review-4 and Documentation stage is taken for 150 marks Evaluation