MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent unit of MAHE, Manipal)

WEB CONTROLLED SURVEILLANCE ROBOT CAR USING RASPBERRY PI

A undergraduate Industrial training Report submitted to MAHE, Manipal in partial fulfilment of the requirement for the award of the degree of

BACHELOR OF TECHNOLOGY
In
Instrumentation and Control Engineering

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ABSTRACT

Raspberry Pi is a card sized computer. It functions almost same as a computer. There are different types of surveillance systems available such as camera, CCTV etc., In these types of surveillance systems, the person who is stationary and is located in that particular area can only be able to view what is happening in that place. Whereas, here, even if the user is moving from one place to another, he/she can keep track of what is happening in that place at exact time. Also, another advantage is that it offers privacy on both sides since it is being viewed by only one person.

The other big advantage is that it is a easy and simple circuit for understanding and designing. The operating system used here is Raspbian OS. Raspbian OS must be installed so that the image can be transmitted to the smartphone. Closed circuit television monitoring system has now become an indispensable device in today's society. Robots have found an drastically increasing demand for different range of work in our life. Their use in army and other security sector increases day by day.

Our paper includes one such instance of how a robot can be of use to human race in general. In this project, we use the internet to establish communication between the user and a robotic vehicle. This is a dependable connection, and a continuous video feedback is available to control the robotic vehicle. Due to the use of the web, there is no limitation on range or distance between the user and the robotic vehicle. It is proposed to address the lower side at cost, efficient, high-speed processing & control hardware for the self-navigating robotics application. Design and Implementation of a Robotic Vehicle with Real-Time Video Feedback Control via Internet/web paper illustrate on an approach to control a robotic vehicle using the internet as the communication medium between the user and robotic vehicle. Raspbian OS must be installed so that the image and videos can be seen to the smartphone directly.

Closed circuit television monitoring system has now become an indispensable device today. There are afferent places such as school, supermarkets, society security where we are having their own CCTV system for 24/7 monitoring

ACKNOWLEDGEMENT

I would like to express my gratitude and appreciation to all those who gave me the possibility to complete this report. A special thanks to my project Coordinator, Ms. Reetika Vats whose help, stimulating suggestions and encouragement, helped me to coordinate my project especially in writing this report. I am really thankful for her full efforts in guiding the team in achieving the goal as well as her encouragement to maintain our progress in track.

I would also like to acknowledge with much appreciation the crucial role of the staff of Electrical Engineering Department, LASTEC, DRDO who gave the permission to use all required machinery and the necessary material to complete the project.

A special thanks goes to my team mates, who helped me to assemble the parts and gave suggestion about how the simulation can be done easily and efficiently. Working with them was indeed a pleasure.

I am grateful to the Officer-in-charge Technical Information Center for allowing to use the well organized and rich Knowledge Centre facility.

In the process I might have missed some other department of this establishment who might have extended me their support in making my stay in this establishment memorable, I wish to thank them for their support.

Finally, many thanks go to Dr. Indu Gupta, Addl. Director, Human Resource and Development Department, LASTEC, DRDO, who gave us this opportunity to carry out this training and complete this project.

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Manipal, Karnataka

BONAFIDE CERTIFICATE

This is to certify that this project report entitled "**Web Controlled Surveillance Robot Using Raspberry Pi"** submitted to **"Laser Science and Technology Centre (LASTEC), DEFENCE RESEARCH AND DEVELOPMENT ORGANISATION, DELHI"**, is a bonafide record of work done by Chahat Segan, B.Tech, Department of Instrumentation and Control, Manipal Institute , Karnataka under supervision of Ms. Reetika Vats, Scientist "D", ELECTRONICS DEPARTMENT from **28th May** to **9th July, 2019.** During this period, she worked under my guidance and supervision. She has successfully completed the above Projects assigned by me. During her Training she was sincere and showed keen interest in doing her Projects, thus completing it in stipulated time.

Ms. Reetika Vats
Sc-"D"

Ms. Sandhya Bajaj
Sc-"G"

ABOUT DRDO

HISTORY

The DRDO was established in 1958 by amalgamating the Defence Science Organisation and some of the technical development establishments. A separate Department of Defence Research and Development was formed in 1980 which later on administered DRDO and its 50 laboratories/establishments. Most of the time the Defence Research Development Organisation was treated as if it was a vendor and the Army Headquarters or the Air Headquarters were the customers. Because the Army and the Air Force themselves did not have any design or construction responsibility, they tended to treat the designer or Indian industry at par with their corresponding designer in the world market. If they could get a MiG-21 from the world market, they wanted a MiG-21 from DRDO.

Fig 1: DRDO Bhawan, New Delhi

DRDO started its first major project in surface-to-air missiles (SAM) known as Project Indigo in 1960s. Indigo was discontinued in later years without achieving full success. Project Indigo led to Project Devil, along with Project Valiant, to develop short-range SAM and ICBM in the 1970s. Project Devil itself led to the later development of the Prithvi missile under the Integrated Guided Missile Development Programme (IGMDP) in the 1980s. IGMDP was an Indian Ministry of Defence programme between the early 1980s and 2007 for the development of a comprehensive range of missiles, including the Agni missile, Prithvi ballistic missile, Akash missile, Trishul missile and Nag Missile. In 2010, then defence minister A. K. Antony ordered the restructuring of the DRDO to give 'a major boost to defence research in the country and to ensure effective participation of the private sector in defence technology'. The programmes which were largely managed by DRDO have seen considerable success with many of the systems seeing rapid deployment as well as yielding significant technological benefits. DRDO has achieved many successes since its establishment in developing other major systems and critical technologies such as aircraft avionics, UAVs, small arms, artillery systems, EW Systems, tanks and armoured vehicles, sonar systems, command and control systems and missile systems.

Defence Research & Development Organisation (DRDO) works under Department of Defence Research and Development of Ministry of Defence. DRDO dedicatedly working towards enhancing self-reliance in Defence Systems and undertakes design & development leading to production of world class weapon systems and equipment in accordance with the expressed needs and the qualitative

requirements laid down by the three services.

Fig 2: DRDO Headquarters

DRDO is one of the prestigious organizations of the country in the field of Science and Technology, which could transform our country's Defense force into one of the most modern and powerful force in the world. It was established by merging together the Scientific and Technical Development Establishment under three services headquarters in 1958, with the aim of creating an organization that can take up the challenges of developing and delivering the high technology in the field of modern warfare, weapon system, avionics and other scientific aspects of nation's defense. It has also got mandate to modernize Defense Technology. DRDO is working in various areas of military technology which include aeronautics, armaments, combat vehicles, electronics, instrumentation engineering systems, missiles, materials, naval systems, advanced computing, simulation and life sciences. DRDO while striving to meet the Cutting-edge weapons technology requirements provides ample spinoff benefits to the society at large thereby contributing to the nation building.

Vision

Make India prosperous by establishing world-class science and technology base and provide our Defence Services decisive edge by equipping them with internationally competitive systems and solutions.

Mission

- Design, develop and lead to production state-of-the-art sensors, weapon systems, platforms and allied equipment for our Defence Services.
- Provide technological solutions to the Defence Services to optimize combat effectiveness and to promote well-being of the troops.
- Develop infrastructure and committed quality manpower and build strong technology base.
- Core Competence
- Dep't of Defence Research and Development (R&D) is working for indigenous development of weapons, sensors & platforms required by the three wings of the Armed Forces. To fulfill this mandate, Dep't of Defence Research and Development (R&D), is closely working with academic institutions, Research and Development (R&D) Centres and production agencies of Science and Technology (S&T) Ministries/Depts. in Public & Civil Sector including Defence Public Sector Undertakings & Ordnance Factories.

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Defence Research & Development services (DRDS)

Recruitment and selection of right people with desired competencies form the base of building an effective organisation. Defence Research & Development Organisation recruit/select scientists and engineers through an annual competitive examination at national level called Scientist Entry Test (SET) through open advertisement. In addition to this, talent search through campus interviews, scholarship scheme through Aeronautics Research & Development Board (ARDB) and fresh Ph.D scholars under Registration of Students with Scholastic Aptitude (ROSSA) is also launched.

Defence Research Technical Cadre (DRTC)

The members of this cadre form strong skilled manpower base to assist scientists and engineers engaged in research and development work.

Admin and Allied Cadre

The members of Admin & Allied cadre provide administrative/establishment support. Personnel for officer post are recruited through UPSC and non-gazette personnel are recruited by the laboratories/establishments as per the notified Recruitment Rules.

Training and Development

DRDO has a dynamic training and development policy which is executed through the Continuing Educational Programmes (CEP) for all cadre personnel viz DRDS, DRTC, and Admin & Allied. At the entry level in DRDS, the newly recruited scientists undergo a 16 weeks Induction Course at Institute of Armament Technology (IAT), Pune. Under the Research and Training (R&T) scheme the scientists are sponsored for ME/M Tech programmes at IITs/IISc and reputed universities. The fees is also reimbursed by the DRDO where scientists undergo Ph.D programme. In addition to this, the Organisation through its two premier Institutes namely Institute of Technology Management (ITM) and Institute of Armament Technology (IAT) deemed university offer courses for scientists and Armed Forces in the area of Technology Management, R&D Management and Armament. Recently, a training centre at Jodhpur has been established to meet the training needs for Admin & Allied cadre. In order to attract the futuristic talent, DRDO has Junior Research Fellow (JRF), Senior Research Fellow (SRF) and Research Associate (RA) schemes for young & dynamic personnel & interested in Defence Research and Development.

Flexible Complementing Scheme

In DRDO, under DRDS Rules 1979, as amended from time to time, Flexible Complementing Scheme (FCS) for promotion up to the grade of Scientist 'G' from one grade to the next higher grade

is in force, w.e.f. 01 Jul 1990. The post held by scientist shall stand upgraded automatically to the next higher grade on Merit-based promotion under the FCS. DRDO operates a fully Flexible Complementing Scheme (FCS) wherein, the post is upgraded automatically up to the grade of SC 'H'. FCS operates on the basis of evaluation of Confidential Performance Appraisal Report (C-PAR) and interviews of Scientists in the grades of Scientist 'B' to Scientist 'E' by Assessment Boards and assessment of Scientist 'F' to Scientist 'G' by Peer Review.

LASER SCIENCE & TECHNOLOGY CENTRE

Laser Science & Technology Centre (LASTEC), Delhi has its origin as Defence Science Laboratory (DSL) established as a nucleus laboratory of DRDO in 1952. In the beginning DSL operated from National Physical Laboratory (NPL) building. Later in 1960, it was shifted to Metcalfe House. In 1982, the DSL moved to its new technical building in Metcalfe House complex and was renamed as Defence Science Centre (DScC). In 1999, in view of the R&D thrust shifting to development of lasers and optoelectronics systems & related technologies, the laboratory was rechristened as Laser Science & Technology Center (LASTEC). With time, many of DSL activities were given to newly formed, specialised DRDO laboratories. DSL has served as a precursor for as many as 15 present DRDO labs, which include DRDL, SSPL, INMAS, FRL, ISSA, DESIDOC, CFEES, SAG and ITM.

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Vision:

Be a centre of excellence in the field of lasers and their defence applications.

Mission:

- Develop high power laser sources and related technologies for directed energy applications.
- Develop technologies and systems for laser support measures like CBRNE detectors, weapon locators, laser illuminators etc.
- Develop laser countermeasure systems, including non-lethal systems.
- Carry out advanced directed research in the fields of lasers and photonics

OBJECTIVE: -

To Build a surveillance robot that uses Raspberry Pi as a microcontroller and transmits live video footage over the internet. The robot is also programmed to get instructions from a user at a remote location.

REQUIREMENTS: -

Keyboard, Mouse, Display screen (TV/Desktop PC), Basic Linux Commands

HARDWARE USED: -

- Raspberry Pi Model 3 B+
- USB Connector Cable
- L293D Motor Driver
- DC Motors
- Wooden Chassis
- HDMI Cable
- Quantum QHM495LM Webcam
- Screws and Nuts
- Wire Strippers & Screw Drivers
- Wheels
- Micro SD Card (16 GB)
- Four 1.5V Batteries

SOFTWARE & OTHER CONCEPTS USED: -

- Noobs (New Out of Box Software)
- Motion (Surveillance Software)
- Flask (Micro-web Framework)
- IDLE (Integrated development Environment)

THEORY & EXPLANATION: -

Raspberry Pi :

The **Raspberry Pi** is a series of single-board computers developed in the UK by the Raspberry pi Foundation to promote teaching of basic computer science in schools and in developing countries. The original model became far more popular than anticipated, selling outside its target market for uses such as robotics. It does not include peripherals (such as keyboards and mouse) and cases. However, some accessories have been included in several official and unofficial bundles.

The Raspberry Pi Foundation provides Raspbian a Debian-based Linux distribution for download, as well as third-party Ubuntu, Windows 10 IoT Core, RISC OS, and specialised media centre distributions. It promotes Python and Scratch as the main programming languages, with

support for many other languages. The default firmware is closed source, while an unofficial open source is available. Many other operating systems can also run on the Raspberry Pi, including the formally verified microkernel, seL4. Other third-party operating systems available via the official website include Ubuntu MATE, Windows 10 IoT Core, RISC OS and specialised distributions for the Kodi media centre and classroom management.

Various operating systems for the Raspberry Pi can be installed on a MicroSD, MiniSD or SD card, depending on the board and available adapters.

Fig 3: The Raspberry Pi Circuit Board

Raspberry Pi 3 B+:

The Raspberry Pi Compute Module 3+ (CM3+) is a range of DDR2-SODIMM-mechanically-compatible System on Modules (SoMs) containing processor, memory, eMMC Flash (on non-Lite variants) and supporting power circuitry. These modules allow a designer to leverage the Raspberry Pi hardware and software stack in their own custom systems and form factors. In addition, these modules have extra IO interfaces over and above what is available on the Raspberry Pi model A/B boards, opening up more options for the design.

FEATURES-

- Hardware
  - Low cost
  - Low power
  - High availability
  - High reliability
  - Tested over millions of Raspberry Pis Produced to date
  - Module IO pins have 15 micro-inch hard gold plating over 2.5 micron Nickel

- Peripherals
  - 40x GPIO
  - 2x I2C
  - 2x SPI
  - 2x UART
  - 2x SD/SDIO

- 1x HDMI 1.3a
- 1x USB2 HOST/OTG
- 1x DPI (Parallel RGB Display)
- 1x NAND interface (SMI)
- 1x 4-lane CSI Camera Interface (up to 1Gbps per lane)
- 1x 2-lane CSI Camera Interface (up to 1Gbps per lane)
- 1x 4-lane DSI Display Interface (up to 1Gbps per lane)
- 1x 2-lane DSI Display Interface (up to 1Gbps per lane)

❖ Software

- ARMv8 Instruction Set
- Mature and stable Linux software stack
- Latest Linux Kernel support
- Many drivers up streamed
- Stable and well supported userland
- Full availability of GPU functions using standard APIs

❖ Power Requirements

Exact power requirements will be heavily dependent upon the individual use case. If an on-chip subsystem is unused, it is usually in a low power state or completely turned off. For instance, if your application does not use 3D graphics then a large part of the core digital logic will never turn on and need power. This is also the case for camera and display interfaces, HDMI, USB interfaces, video encoders and decoders, and so on.

❖ GPIO

Fig 4: GPIO pin configuration of Raspberry Pi

BCM2837 has in total 40 GPIO lines in 3 separate voltage banks. All GPIO pins have at least two alternative functions within the SoC. When not used for the alternate peripheral function, each

GPIO pin may be set as an input (optionally as an interrupt) or an output. The alternate functions are usually peripheral I/Os, and most peripherals appear twice to allow flexibility on the choice of I/O voltage.

GPIO bank2 is used on the module to connect to the eMMC device and for an on-board I2C bus (to talk to the core SMPS and control the special function pins). On CM3+ Lite most of bank2 is exposed to allow a user to connect their choice of SD card or eMMC device (if required).

Bank0 and 1 GPIOs are available for general use. GPIO0 to GPIO27 are bank0 and GPIO28-45 makeup bank1. GPIO0-27 VDD is the power supply for bank0 and GPIO28-45 VDD is the power supply for bank1. SDX VDD is the supply for bank2 on CM3+ Lite. These supplies can be in the range 1.8V-3.3V and are not optional; each bank must be powered, even when none of the GPIOs for that bank is used.

Note that the HDMI HPD N 1V8 and EMMC EN N 1V8 pins are 1.8V IO and are used for special functions (HDMI hot plug detect and boot control respectively). Please do not use these pins for any other purpose, as the software for the module will always expect these pins to have these special functions. If they are un-used please leave them unconnected.

- USB

The BCM2837 USB port is On-The-Go (OTG) capable. If using either as a fixed slave or fixed master, please tie the USB OTGID pin to ground. The USB port (Pins USB DP and USB DM) must be routed as 90 ohm differential PCB traces.

- HDMI

BCM283x supports HDMI V1.3a. It is recommended that users follow a similar arrangement to the Compute Module IO Board circuitry for HDMI output. The HDMI CK P/N (clock) and D0-D2 P/N (data) pins must each be routed as matched length 100 ohm differential PCB traces. It is also important to make sure that each differential pair is closely phase matched. Finally, keep HDMI traces well away from other noise sources and as short as possible.
Failure to observe these design rules is likely to result in EMC failure.

- Ethernet -

The Pi 3B+ uses a Microchip LAN7515 chip for ethernet and USB 2.0 hub. So it can take advantage of a Gigbit ethernet connection, but because of USB 2.0 limitations, its maximum throughput is 330 Mbit.

- Composite (TV Out)

The TVDAC pin can be used to output composite video (PAL or NTSC). Please route this signal away From noise sources and use a 75 ohm PCB trace. Note that the TV DAC is powered from the VDAC supply which must be a clean supply of 2.5-2.8V. It is recommended users generate this supply from 3V3 using a low noise LDO. If the TVDAC output is not used VDAC can be connected to 3V3, but it must be powered even if the TV-out functionality is unused.

L293D IC (Motor Driver):

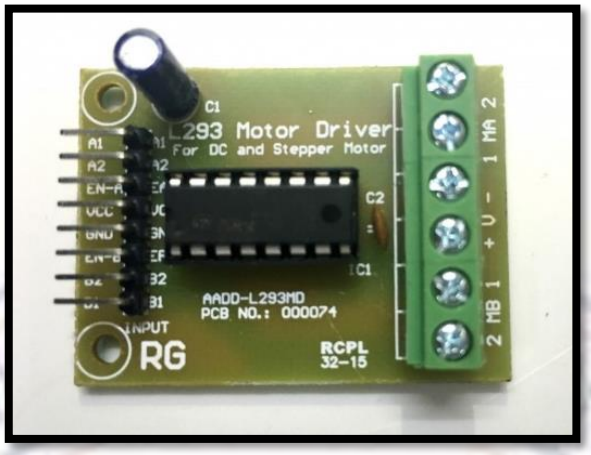


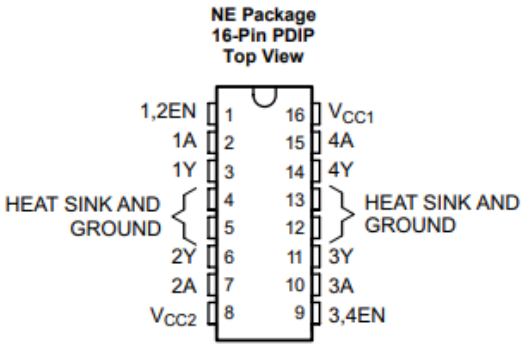
Fig 5: L293D IC

The L293 and L293D are quadruple high-current half-H drivers. These devices are designed to drive a wide array of inductive loads such as relays, solenoids, DC and bipolar stepping motors, as well as other high-current and high-voltage loads.

All inputs are TTL compatible and tolerant up to 7 V. Each output is a complete totem-pole drive circuit, with a Darlington transistor sink and a pseudo-Darlington source. Drivers are enabled in pairs, with drivers 1 and 2 enabled by 1,2EN and drivers 3 and 4 enabled by 3,4EN. When an enable input is high, the associated drivers are enabled, and their outputs are active and in phase with their inputs. When the enable input is low, those drivers are disabled, and their outputs are off and in the high-impedance state. With the proper data inputs, each pair of drivers forms a full-H (or bridge) reversible drive suitable for solenoid or motor applications. On the L293, external high-speed output clamp diodes should be used for inductive transient suppression.

On the L293D, these diodes are integrated to reduce system complexity and overall system size. A VCC1 terminal, separate from VCC2, is provided for the logic inputs to minimize device power dissipation. The L293 and L293D are characterized for operation from 0°C to 70°C.

VCC1 is 5 V ± 0.5 V and VCC2 can be same supply as VCC1 or a higher voltage supply with peak voltage up to 36 V. Bypass capacitors of 0.1 uF or greater should be used at VCC1 and VCC2 pins. There are no power up or power down supply sequence order requirements. Properly heatsinking the L293 when driving high-current is critical to design. The Rthj-amp of the L293 can be reduced by soldering the GND pins to a suitable copper area of the printed circuit board or to an external heat sink.



Pin Functions

PIN		TYPE	DESCRIPTION
NAME	NO.		
1,2EN	1	I	Enable driver channels 1 and 2 (active high input)
<1:4>A	2, 7, 10, 15	I	Driver inputs, noninverting
<1:4>Y	3, 6, 11, 14	O	Driver outputs
3,4EN	9	I	Enable driver channels 3 and 4 (active high input)
GROUND	4, 5, 12, 13	—	Device ground and heat sink pin. Connect to printed-circuit-board ground plane with multiple solid vias
V_{CC1}	16	—	5-V supply for internal logic translation
V_{CC2}	8	—	Power VCC for drivers 4.5 V to 36 V

Fig 6: Pin configuration and functions of L293D IC

DC Motor Control:

The L293 device can be used as a simple driver for a motor to turn on and off in one direction and can also be used to drive a motor in both directions. Refer to the function tables below to understand unidirectional vs bidirectional motor control. Refer to the Recommended Operating Conditions when considering the appropriate input high and input low voltage levels to enable each channel of the device.

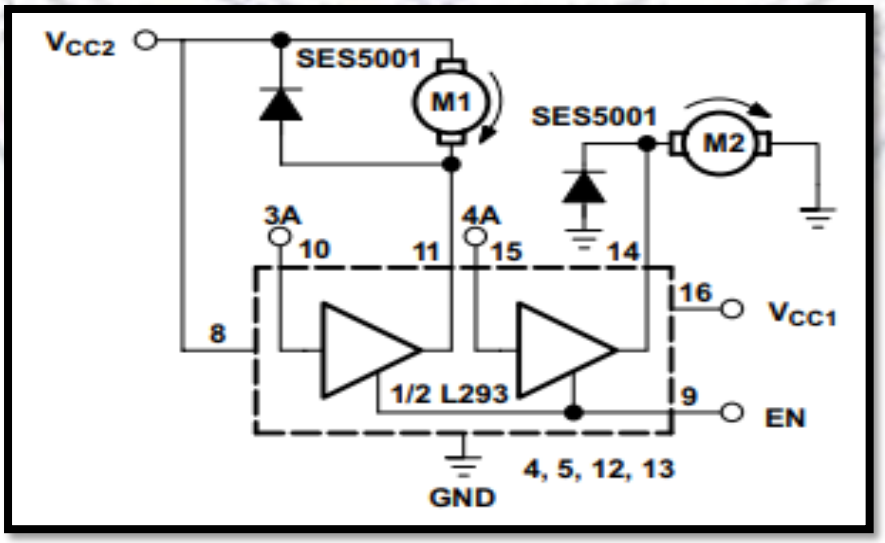


Fig 7: Motor Control though IC pins

Table 2. Unidirectional DC Motor Control

EN	3A	M1 (1)	4A	M2
H	H	Fast motor stop	H	Run
H	L	run	L	Fast motor stop
L	X	Free-running motor stop	X	Free-running motor stop

(1) L = low, H = high, X = don't care

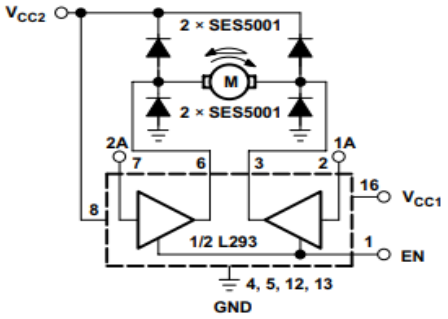


Figure 10. Bidirectional DC Motor Control

Table 3. Bidirectional DC Motor Control

EN	1A	2A	FUNCTION (1)
H	L	H	Turn right
H	H	L	Turn left

(1) L = low, H = high, X = don't care

Fig 8: Inputs for Unidirectional & Bidirectional DC Motor Control

Robot Car Chassis Kit:

Robotic Car Chassis kit includes the following items

- Transparent Acrylic Base that comes with a protective brown paper cover.
- Two Geared DC Motors
- 4xAA Battery Holder
- Supporting castor wheel
- Two encoder disks
- A Power Switch
- Two Plastic Wheels
- Mounting screws and nuts It is a ideal kit for building various robotic applications using microcontroller boards like Arduino, Raspberry Pi etc.

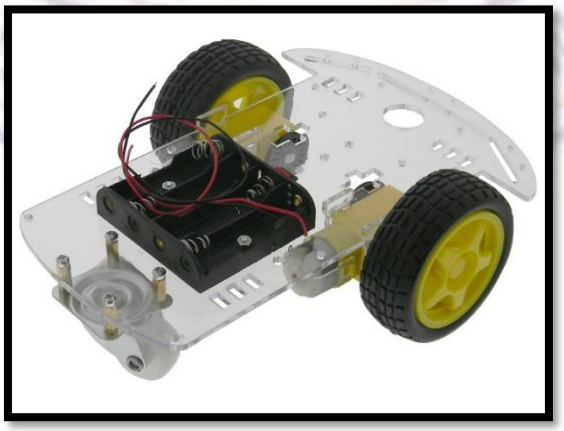


Fig 9: Robot Chassis after assembly

BLOCK DIAGRAM: -

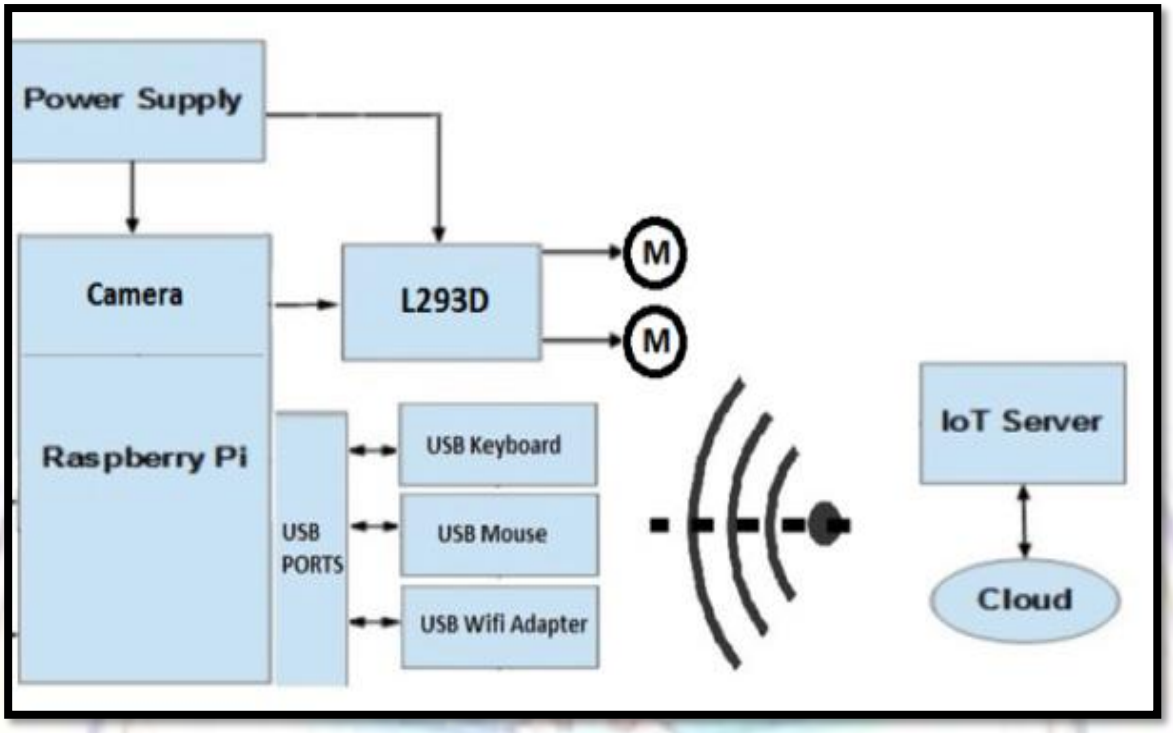


Fig 10: Block diagram of the project

CIRCUIT DIAGRAM AND CONNECTIONS: -

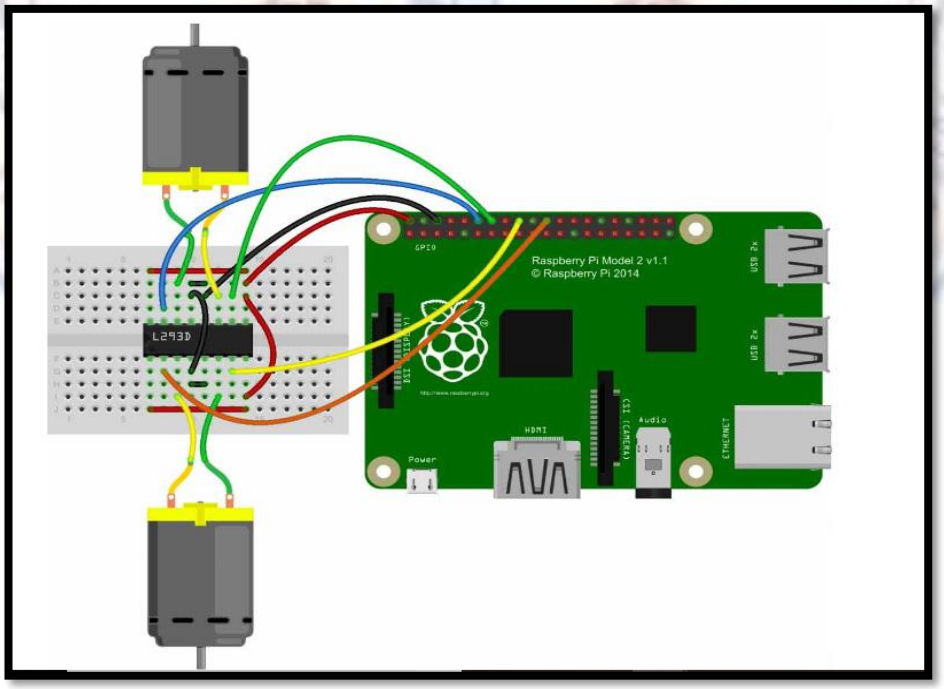


Fig 11: Diagram of connection to the circuitry

SOFTWARE DESCRIPTION & CODE USED: -

Flask:

Flask is a micro web framework written in Python. It is classified as a micro-framework because it does not require particular tools or libraries. It has no database abstraction layer, form validation, or any other components where pre-existing third-party libraries provide common functions. However, Flask supports extensions that can add application features as if they were implemented in Flask itself. Extensions exist for object-relational mappers, form validation, upload handling, various open authentication technologies and several common framework related tools. Extensions are updated far more regularly than the core Flask program. Here, we have created a web server using Flask, which provides a way to send the commands from webpage to Raspberry Pi to control the Robot over the network. Flask allows us to run our python scripts through a webpage and we can send & receive data from Raspberry Pi to web browser and vice versa. Flask is a micro-framework for Python. This tool is Unicode based having built-in development server and debugger, integrated unit testing support, support for secure cookies and it's easy to use, these things make it useful for the hobbyist.

HTML code for webpage:

We created a web page using the HTML language for displaying control links (Left, Right, Forward, backward) to move the Robot using the web browser. We used jQuery script to call the functions in Our Python Program. There are five functions in Python Code to move the Robot Left, Right, Forward, Backward and to stop the Robot Car. These functions will be executed by clicking on the Control Links on webpage and motors will move depending on the link being clicked. The code is written in such a way that Robot will move in certain direction while clicking and holding the link, and as soon as we release the mouse button Robot will stop. Given below is the HTML code for webpage including the jQuery:

```
<html>

<head>

<script src="https://ajax.googleapis.com/ajax/libs/jquery/3.1.1/jquery.min.js"></script>

</head>

<body>



<img src="http://192.168.13.201:8081" /> <!the IP Address of our Raspberry Pi

<div style="float:right">
```

```
</div>

<div style=" height:400px; width:300px; float:right;">

<center>

<h1><span style="color:#5C5C5C;">GROUP</span><span style="color:#139442">
ONE</span></h1>

<h2>Surveillance Robot</h2><br><br>

<a href="#" id="up" style="font-size:30px;text-decoration:none;">
&#x1F881;&#x1F881;<br>Forward</a><br><br></center>

<a href="#" id="left" style="font-size:30px;text-decoration:none;">
&#x1F880;&#x1F880;Left</a>        

<a href="#" id="right" style="font-size:30px; text-decoration:none;"> Right
&#x1F882;&#x1F882;</a><br><br>

<center><a href="#" id="down" style="font-size:30px;text-decoration:none;"> Backward<br>
&#x1F883;&#x1F883;</a></center>

</div>

<script>

$( document ).ready(function(){

    $("#down").on("mousedown", function() {

     $.get('/down_side');

     }).on('mouseup', function() {

     $.get('/stop');

    });

    $("#up").on("mousedown", function() {

     $.get('/up_side');

     }).on('mouseup', function() {

     $.get('/stop');

    });

    $("#left").on("mousedown", function() {

     $.get('/left_side');
```

```
     }).on('mouseup', function() {
     $.get('/stop');
    });
    $("#right").on("mousedown", function() {
     $.get('/right_side');
     }).on('mouseup', function() {
     $.get('/stop');
    });
});
</script>
</body>
</html>
```

Motion:

Motion, a software motion detector, is a free software CCTV software application developed for Linux. Motion is a highly configurable program that monitors video signals from many types of cameras. Set it up to monitor your security cameras, watch birds, check in on your pet, create time-lapse videos and more. It can monitor video signal from one or more cameras and is able to detect if a significant part of the picture has changed saving away video when it detects that motion is occurring.

Motion is free, open source motion detector CCTV software, developed for Linux. It detects the motion and start recording video of it. With 'Motion' installed in our Raspberry Pi, we can magically turn our Raspberry Pi into a Security Camera and can get following functionalities:

- We can watch Live Video feed on a web browser by entering the IP address of Pi along with the port.
- It will record and save the Video whenever it detects Motion or any disturbance in the view area. It will keep recording the Video until there is some motion, then it stops and save the file, which can be watched later.
- It can create a beautiful Time-lapse Video.
- It can take snapshots at regular interval or when there is some motion. Snapshots are also saved in the disk for later use.

Apart from that, It has several configuration options, we can also set user defined 'triggers' on certain events. Motion currently only support USB camera out of the box.

Customizing Media settings in Motion:

- We can look into some very useful configurations options, using which we can optimize it according to our need and can get very impressive results. In Motion Configuration file, all the settings are explained very nicely with their default and recommenced value and we can check it using below command:

```
sudo nano /etc/motion/motion.conf
```

- Apart from getting the live feed, Motion records and saves video files whenever it detects Motion. So we can adjust the framerate, quality, width/height of the streaming videos. we can set the frame rate high for real time videos, but our network must be fast enough for this one. Below are the values which we have used and they can be changed accordingly:

```
# Image width (pixels). Valid range: Camera dependent, default: 352

width 640

# Image height (pixels). Valid range: Camera dependent, default: 288

height 480

# Maximum number of frames to be captured per second.

# Valid range: 2-100. Default: 100 (almost no limit).

framerate 90

stream_quality 90
```

- We can also take snapshots at regular intervals, defined by us, by using below option:

```
# Make automated snapshot every N seconds (default: 0 = disabled)

snapshot_interval 0
```

- The most attractive features is time-lapse video, it's a very good arrangement for beautiful time-lapse videos in very low cost. Here we can define the interval for the snapshots for Time-lapse Video:

```
Default value 0 = off - else save frame every Nth second

ffmpeg_timelapse 2
```

- The web streaming port can also be change but default is 8081:

```
# The mini-http server listens to this port for requests (default: 0 = disabled)

stream_port 8081
```

- We can instruct Motion to make several clips of particular duration instead of one big file. we can mention the clips duration in seconds (0 for infinite):

```
# Maximum length in seconds of a movie

# When value is exceeded a new movie file is created. (Default: 0 = infinite)

max_movie_time 120
```

- Finally, we've to save and restart the Motion service after changing any setting. To save the motion.conf, CTRL+X then Y is pressed and then Enter.

Thus, these are some common settings that can be used to achieve good results. Other than these, there are lot of options to set brightness, contrast, bit rate, triggers, password authentication and many more.

Python:

To configure the GPIO pins of the Raspberry Pi we make use of the programming language Python. The python code configures the GPIOs and hence control the working of the DC Motors through the IC L293D. It hence controls the forward, backward, right, left and stop motions of the Robotic Car. The following is the code used:

```
from flask import Flask                          // to import the Flask class

from flask import render_template, request

import RPi.GPIO as GPIO

import time



app = Flask(__name__)          // __name__ is a argument; like in a funtion call



l1=40

l2=38

r1=35

r2=37

enr=33                        // set permanently to 1

enl=36
```

```
GPIO.setwarnings(False)

GPIO.setmode(GPIO.BOARD)

GPIO.setup(l1, GPIO.OUT)      //for setup of GPIO's

GPIO.setup(l2, GPIO.OUT)

GPIO.setup(r1, GPIO.OUT)

GPIO.setup(r2, GPIO.OUT)

GPIO.output(l1 , 0)           //to override any prev data

GPIO.output(l2 , 0)

GPIO.output(r1, 0)

GPIO.output(r2, 0)




@app.route("/")                //route() decorator to tell Flask what URL should trigger
our function

def index():

    return render_template('robot.html')        //imports commands from html page



@app.route('/left_side')

def left_side():

    data1="LEFT"                                //left motor stops rotating and right
motor rotates CW = left turn

    GPIO.output(l1 , 0)

    GPIO.output(l2 , 0)

    GPIO.output(r1 , 1)

    GPIO.output(r2 , 0)

    print('Done')

    return 'true'
```

```
@app.route('/right_side')

def right_side():

   data1="RIGHT"                                    //right motor stops rotating and left
motor rotates CW = right turn

   GPIO.output(l1 , 1)

   GPIO.output(l2 , 0)

   GPIO.output(r1 , 0)

   GPIO.output(r2 , 0)

   print('Done')

   return 'true'



@app.route('/up_side')

def up_side():

   data1="FORWARD"                                  //both motor CW = forward

   GPIO.output(l1 , 1)

   GPIO.output(l2 , 0)

   GPIO.output(r1 , 1)

   GPIO.output(r2 , 0)

   print('Done')

   return 'true'



@app.route('/down_side')

def down_side():

   data1="BACK"                                     //both motor ACW = reverse

   GPIO.output(l1 , 0)
```

```
   GPIO.output(l2 , 1)

   GPIO.output(r1 , 0)

   GPIO.output(r2 , 1)

   print('Done')

   return 'true'



@app.route('/stop')

def stop():

   data1="STOP"                                  //both motor stop= stop

   GPIO.output(l1 , 0)

   GPIO.output(l2 , 0)

   GPIO.output(r1 , 0)

   GPIO.output(r2 , 0)

   print('Done')

   return  'true'



if __name__ == "__main__":                       // executed first

 print "Start"

 app.run(host='0.0.0.0',port=5010)              // fuction call for app run; gets
commands from website

                                                 // ‘0.0.0.0’ to have server available
externally
```

OBSERVATIONS: -

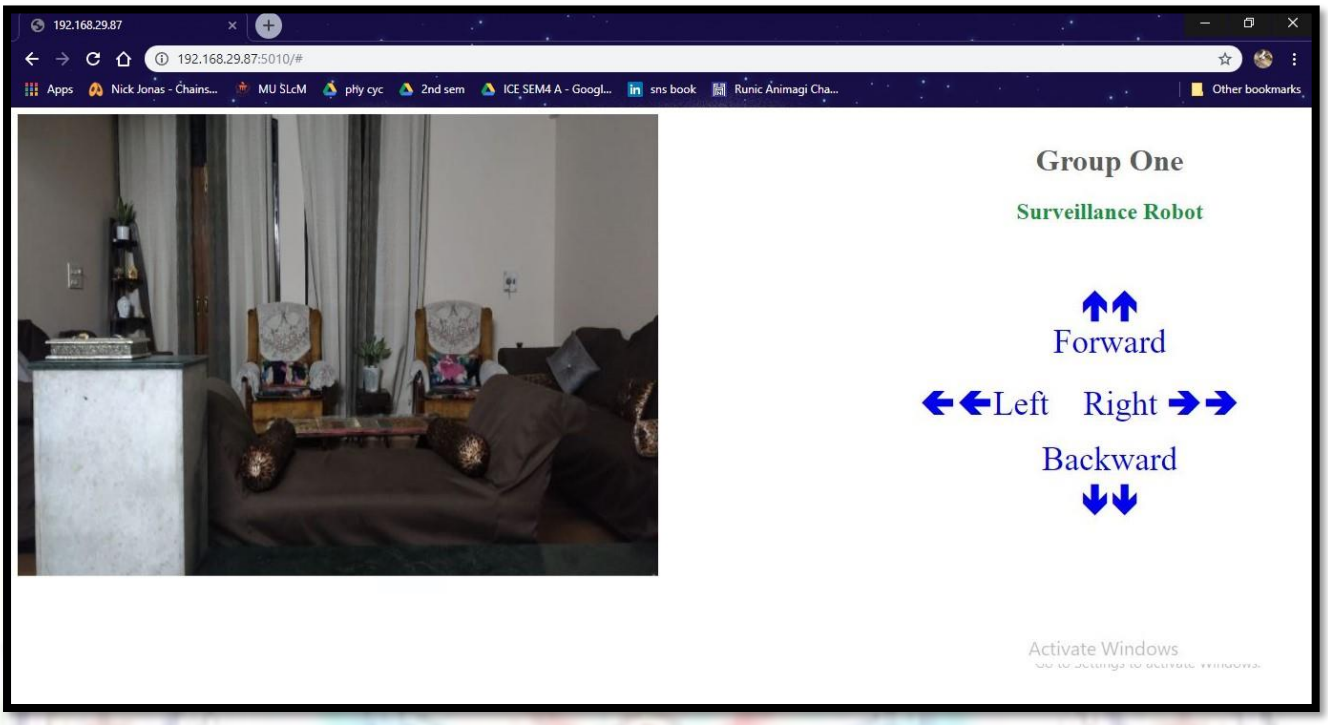
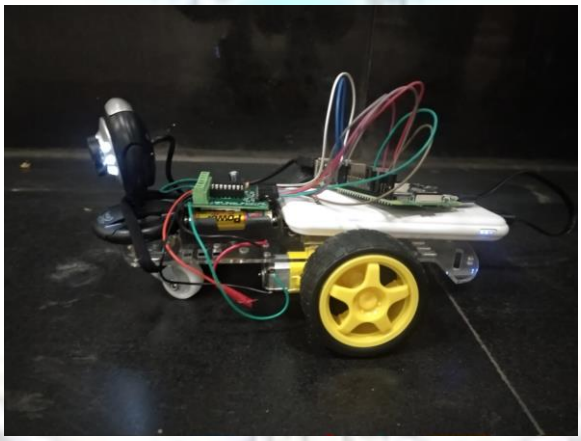
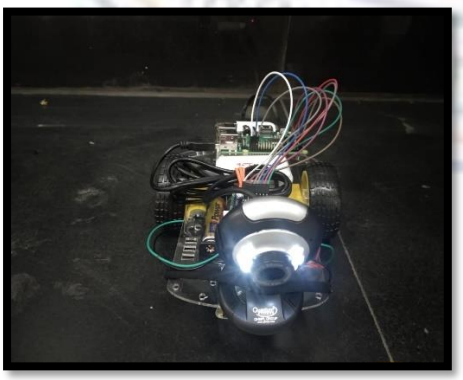


Fig 12: The webpage as seen from another device.





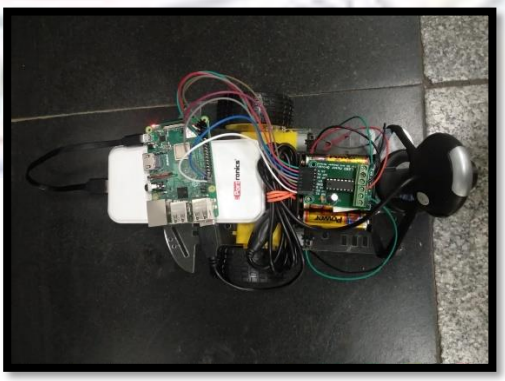


Fig 13: Surveillance Robot after Assembly

APPLICATIONS: -

As we know, with increasing threats and number of crimes, the tech world is trying to look for new, progressive, and different ideas in surveillance. Our robot car is a genuine initiative towards the development of security and surveillance which is built from low cost components and basic knowledge of coding and electronics. Our robot car can be used as a security, spy tool on a low budget scale. It can also be used as a remote-controlled car without mounting the camera on top.
A high budget model of this project can be used in day to day security/surveillance, offices, defence, military etc.

Raspberry pi also has these following applications-

- Retro gaming
- Raspberry pi Tablet
- Low-cost Desktop PC
- Raspberry pi Clutter
- Raspberry pi cloud server
- Raspberry pi Media centre
- Web Server
- Home Automation System
- VPN
- Pi Phone
- In the field of Robotics

CONCLUSION: –

The Raspberry Pi is a low cost, **credit-card sized computer** that plugs into a computer monitor or TV and uses a standard keyboard and mouse. It is a capable little device that enables people of all ages to explore computing, and to learn how to program in languages like Scratch and Python. It's capable of doing everything you'd expect a desktop computer to do, from browsing the internet and playing high-definition video, to making spreadsheets, word-processing, and playing games.
The motor driver and the robot building help us use our classroom knowledge of electronics and electrical to application.

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