iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 8 **Issue:** V **Month of publication:** May 2020

DOI: http://doi.org/10.22214/ijraset.2020.5137

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 8 Issue V May 2020- Available at www.ijraset.com

Smart Walking Stick for Blind Integrated with SOS Navigation System

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Abstract: ***Blind people face difficulty to interact with the society. The aim of this project is to provide a tool which will help blind people to navigate as well as give the message to the family member. We plan to propose a working model which is Walking Stick with in-built e-SOS (electronic Save Our Souls) Switch and the controller. The Camera is used to click picture of traffic light depending on programming it gives signal to the blind person so that he will navigate safely. On clicking picture webcam sends the data to the Raspberry-pi Controller. By using Image processing controller extract some useful information about the intensity of light and give it to the person through the Headphones. If camera is not working properly then the circuit does nothing. In addition we also plan to connect e-SOS (electronic Save Our Souls) system whenever blind person feels any discomfort while navigating then he press an e-SOS distress call button on the stick to give a message to his family member. Message in the form of link is generated which shows the location of the blind person to his family member. In this way, Blind person is guided to move along the path by his family member via the mail. In this module through GPS and GSM the longitude and latitude of the stick is tracked which help to sent the message to the rilatives in a emergency situation.***
Keywords: Blind, Walking Stick, Alert, e-SOS, Camera, WIFI.

I. INTRODUCTION

According to a report by World Health Organization (WHO) and International Agency for Prevention of Blindness (IAPB) nearly 285 million persons around the world are visually impaired. However a more astonishing fact is that out of these 285 million people, 39 million people are completely blind. They played an essential role in our decision to come up with the very notion of an advanced blind stick. Owing to amount of strain which is being subjected to our eyes, the probabilities in enhancement of number of blind people are bound to rise. The purpose of this blind stick would be to make blind people more independent, [1]. In fact, it will give positive dimensions to their life. The traditional obstacle detection methods are obsolete and need considerable modifications, [2].In this project, we were expected to button on his stick which will enable the process of live streaming system. (Here, live streaming indicates the nearby environment of the blind person) The streaming signal with location is sent to his family member's Android phone via an Android application. An e-SOS is Morse coded distress signal. In simple words, SOS is distress call/ emergency signals which the blind person sends to his family member.

A. Objective Of Project

1) To survey various techniques used for blind stick analysis.
2) To study different hardware and software (python) for blind stick analysis.
3) To calculate the distance of the camera and traffic signal recognition.
4) To analyze the emotions of the person who is not able to this Beautiful world.
5) Study Raspberry-pi controller different features and used them effectively.
6) Develop a model which is easily available for visually impaired person to improve their living.

II. LITERATURE SURVEY

Sr. no.	Year of Publication	Title of paper	Objective of paper	Modifications in our Project
1.	2012	Advanced embedded chatter Box for physically challenging persons	To aid communication for physically challenged people. This paper details how to build a device which can speak out the text given to it by a speaker and helpful for a dumb people as a mouth to them and its LCD Display act as a ear to Deaf people by making them to understand what other people saying them.	We developed a smart stick that useful not only for blind people but also for physically challenged person, Even old age people can able to use it very efficiently.
2.	2014	A Survey of Voice Aided Electronic stick for visually impaired people	They used GPS and GSM system and ultrasonic sensor with Bluetooth earpiece in Designing the electronic stick.	In our project we use GPS System for Location alerting and sharing For giving an instruction we used headphones in place Bluetooth earpiece. we use main Raspberry-pi controller for image processing and for further operations.
3.	2015	MEDICO STICK An Ease to Blind and Deaf	To develop wireless communication future using DTMF Device that help blind and deaf person to walk on street fearlessly.	We used Raspberry-pi instead of microcontroller Raspberry-pi is a mini computer or mini CPU which works on LINUX OS and can handle multiple program running simultaneously.
4.	2015	Design of communication interpreter for Deaf and Dumb people	To Develop a cost effective system which can give voice to voiceless people with help of smart gloves.	We Design smart stick using Raspberry-pi which perform Image-processing required for further operation related to blind person.
5.	2017	Smart stick for visually impaired people	By using Arduino UNO controller and ultrasonic sensor if sensor sensed properly and object detected blind person notified about the object with the help of vibration, blind person location Tracking using GSM and GPS module.	In our project we detect Traffic light with the help of Camera and using image processing, location tracking if the person is lost using GPS and family member know about the exact location through the link on e-mail.

6.	2018	Smart electronic walking stick for blind people	By using Arduino UNO Controller & ultrasonic sensor they developed a smart walking stick. In this model also used temperature sensor heart beat sensor for monitoring physical condition, Also used water sensor for detection of water, sensor sensed water if it is present and notify the person.	As compare to this model we use Raspberry pi 3B+ controller for the effective purpose and we used the GSM and GPS Technology for location sharing.
7.	2018	Advanced Electronics Based Smart Mobility Aid for the Visually Impaired Society	Advanced electronic are employable in assisting the visually impaired society in various ways. first idea is object detection and alert system. The obstacle detection is done using ultrasonic sensor. If the blind person feels uncomfortable with obstacle detection technology, he can switch to SOS based video call technique to get help from his family member or any friend.	In our project we develop a smart stick which is easily operate by visually impaired person and mounting various sensors and using different modules for the welfare of the blind person. Traffic light detection using Image processing and Headphones, family member get exact location on e-mail.
8.	2019	Electronics stick for visually impaired people with Buzzer Alert	In this paper, they make an electronic smart stick for blind people using Arduino UNO and also used Ultrasonic sensor for object detection up-to 20 meters. If the obstacle is in range then buzzer start giving alert, when the person click on the switch then it will be stopped.	In our project we used a Raspberry-pi controller which support image to voice conversion. For the traffic light detection we used IR Sensor instead of Ultrasonic sensor, U.S Used to measure latitude and longitude.

III. FLOWCHART

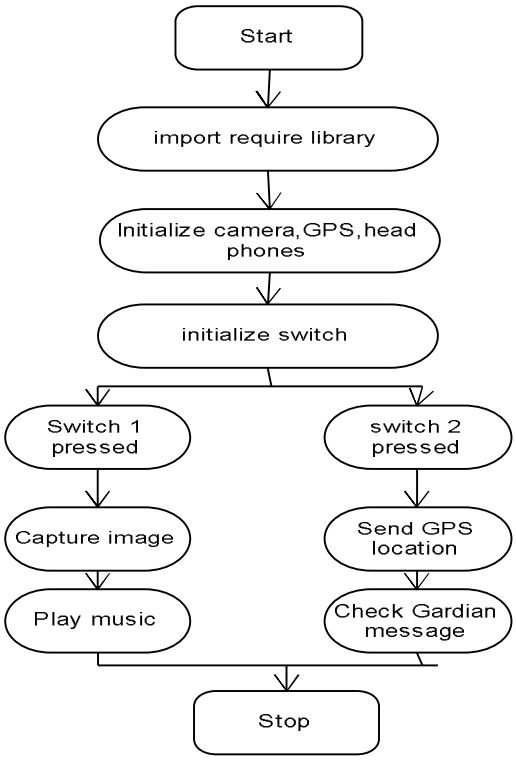

Fig.4.1 :Flowchart

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
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IV. BLOCK DIAGRAM

A. *System Block Diagram*

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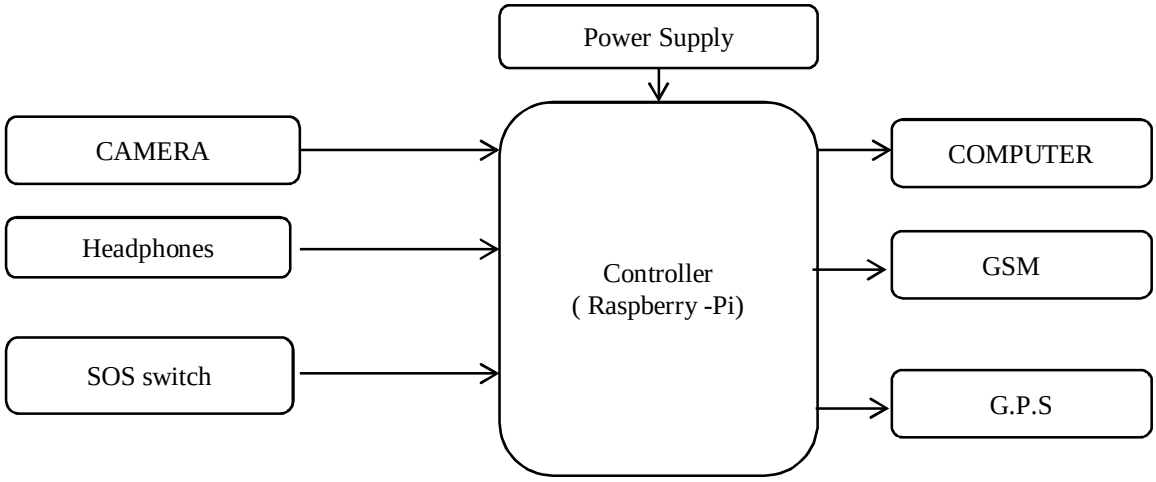


Fig.5.1 : Block Diagram Of Project

B. *Block Diagram Description*

1) *Camera:* A USB webcam is a camera that connects to a computer, usually through connect it in to a USB port on the machine. The video is fed to the computer where a software application lets you able to view the pictures and also transfer them to the Internet with the help of IOT.

2) *Raspberry PI:* This system uses Raspberry pi controller, it is a small processing device which works as computer at relatively low cost. Blind people face difficulties in detecting obstacles and walking on the street. The system is intended to provide artificial vision and real time assistance via GPS by making use of Raspberry Pi Controller. The system consists of GPS module, sensors and the feedback is received through audio via Headphones. The proposed system detects camera which is used to click the picture and using image processing person is able to know the actual traffic light position to cross the road successfully.

3) *GPS:* GPS is a satellite navigation system used to determine the ground position of an object. Today, GPS receivers are included in many commercial products, such as smart phones, automobiles exercise watches, and GIS devices.

4) *SOS Button:* It is simply a push button which will involve in switching the mode of operation of the system.

5) *Other Peripherals:* Other components include power bank, resistors and earphones as hardware peripherals and mobile application.

C. Block Diagram Of Power Supply

Our circuit requires 5V and 9V DC regulated supply it can built around step-down transformer with rectifier and regulator or battery based also. If circuit is connected to power lines the step down transformer or battery supply is required. But for other transmission line it is only battery based, because it cannot drive the transformer.

Power supply mainly consist of four stages namely transformer, rectifier, filter, and regulator. Transformer is step down transformer which steps down the 230V AC input supply to 15V AC at its secondary. This 15V AC is rectified by bridge rectifier consisting of four diodes, which converts the AC output into DC output. The next stage consisting of capacitor, which removes the ripple present in DC output. Capacitor is used as filtering capacitor. Last stage of power supply is the regulator stage. Regulator(IC 7805) IC gives the regulated DC output from the unregulated supply.

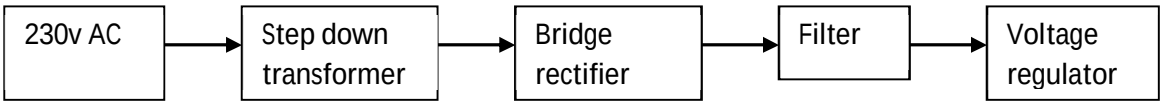


Fig 5.3: block diagram of power supply

1) *Power Supply Simulation:* The basic step in the designing of any system is to design the power supply required for that system. The steps involved in the designing of the power supply are as

Follows,

a) Determine the total current that the system sinks from the supply.

b) Determine the voltage rating required for the different components.

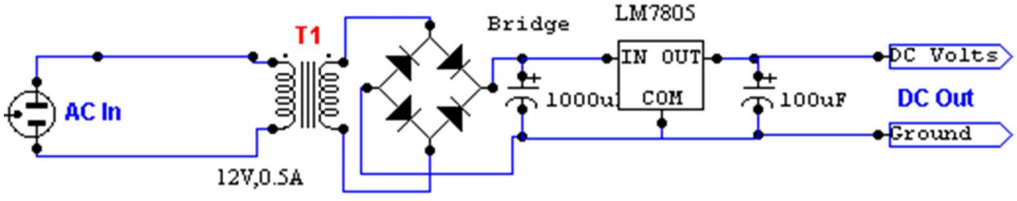


Fig. 5.3.1 Power supply

Transformer selection we required 12V for relay min Input for 7805

= Drop across IC 7805 + Required Output voltage

= 3 V+ 5V = 8 V

So at Input of 7805 we required 8 V with margin

Consider drop across diode 0.7V so 2 diode conducts drop is 1.4 V

= 1.4 V +8 V

= 9.4 V

So at secondary we required 10 V

For filter capacitor design

$C= (I_1 * t_1)/V_r$

V_r= ripple voltage

I_l = load current

T_1= time during which the capacitor being discharge by load current

Θ_1= sin-1[($E_{0\ min}$)/ ($E_{0\ max}$)]

So unregulated power supply is design for 10 V

V_r = ripple voltage 10% of output voltage

V_r = 1.0 V

$E_{0\ min}/E_{0\ max}$ = (10-0.7) / 10+0.7

= 9.3 / 10.7

Θ_1 = sin-1 [9.3/10.7] = 60°

Frequency 50 Hz

T_1 = 1/50 = 20 ms

T for 360° = 20ms

For 180° = 10ms

For 60° = 20ms * (60°/360) = 3.4ms

For bridge

T_1 = [time for 90° + time for θ_1]

= 5ms + 3.4ms

= 8.4ms

I_l = load current supplied to various IC

I_l = (O/P current of atmega16 + O/P current of max232 + Current req. For display + o/p current of L298 + o/p current of ULN 2803A)

= 40ma + 30ma + 15.2 ma+1.35ma+100µa

=87ma

$C = (I_l * t_1)/V_r$

= (87 ma * 8.4 ms)/ 1 V

= 727.86 µf So we select˜ 1000 µf capacitor

For diode design

PIV = V_m

$V_m = E_{0\ max} + 2\ V_f$

= 10.7 + 1.4 V

= 12.1 V

$I_0 = I_l /2$

= 87 ma/ 2

= 43.5 ma

Peak repetitive current

$I_{fm} = [I_l (t_1+t_2)]/t_2$

T_2 = time for 90° - time for θ_1

= 5ms - 3.4ms

=1.2ms

I_{fm} = 87ma(8.6ms+1.2ms) /1.2ms.
=710.5ma
From above specification diode 1N4007 is selected
PIV =100V
I = 1A

V. CIRCUIT DIAGRAM

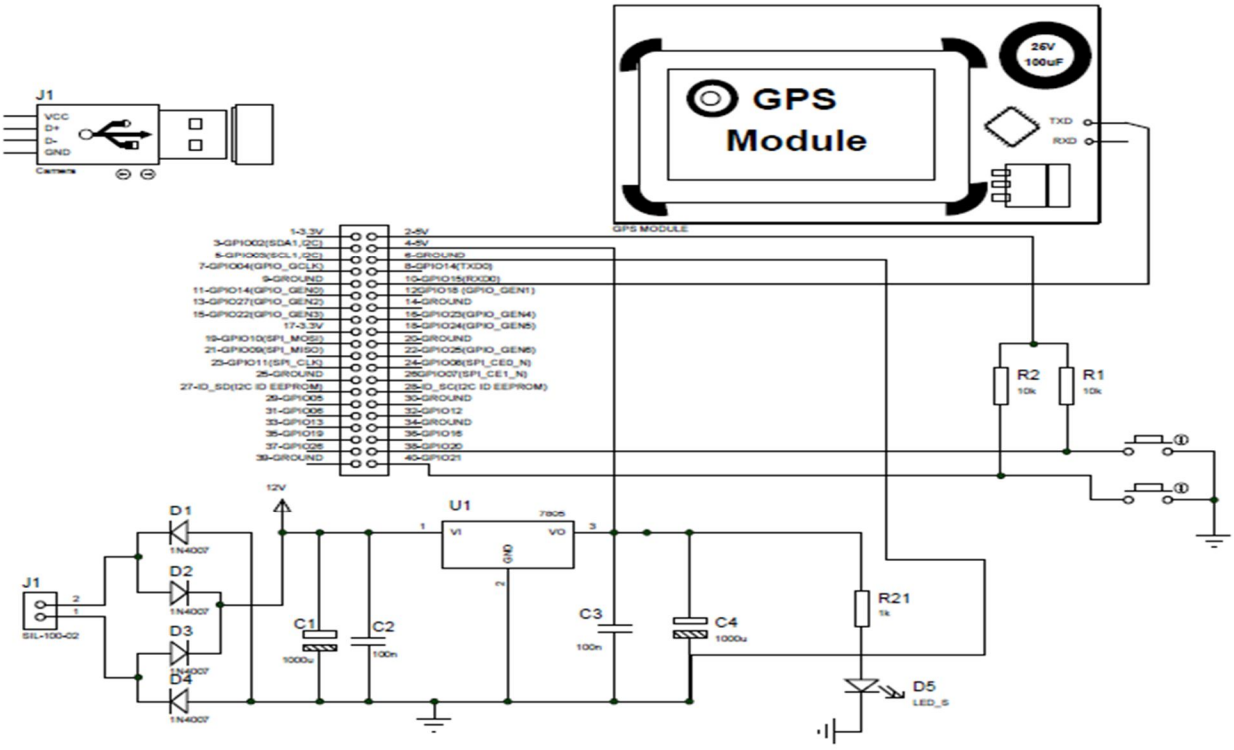
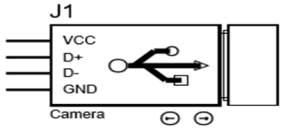


Fig.6 : Circuit Diagram

A. Pin Connection Of Raspberry-Pi



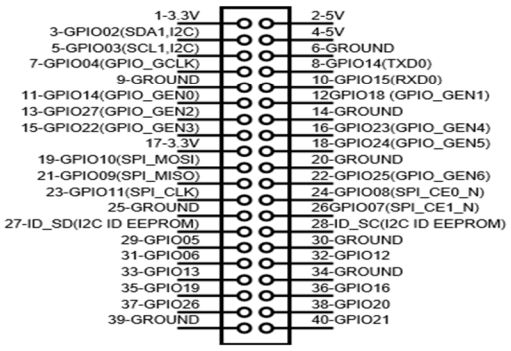


Fig.6.1.1: Raspberry-pi interfacing with webcam

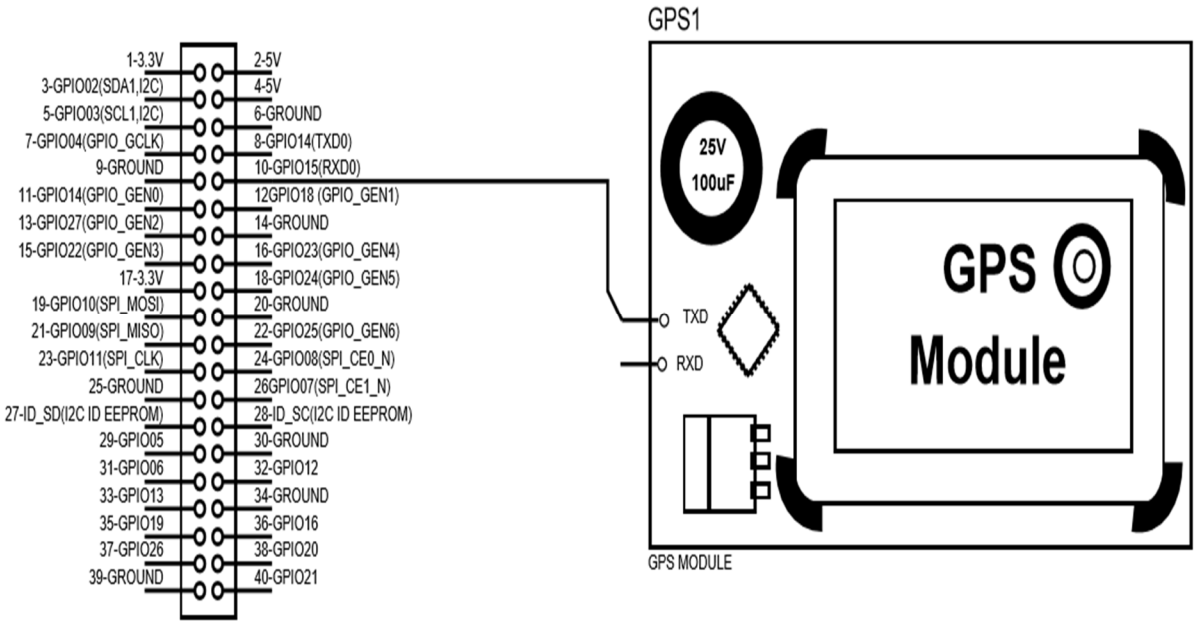


Fig.6.1.2 : Raspberry-pi connection with GPS

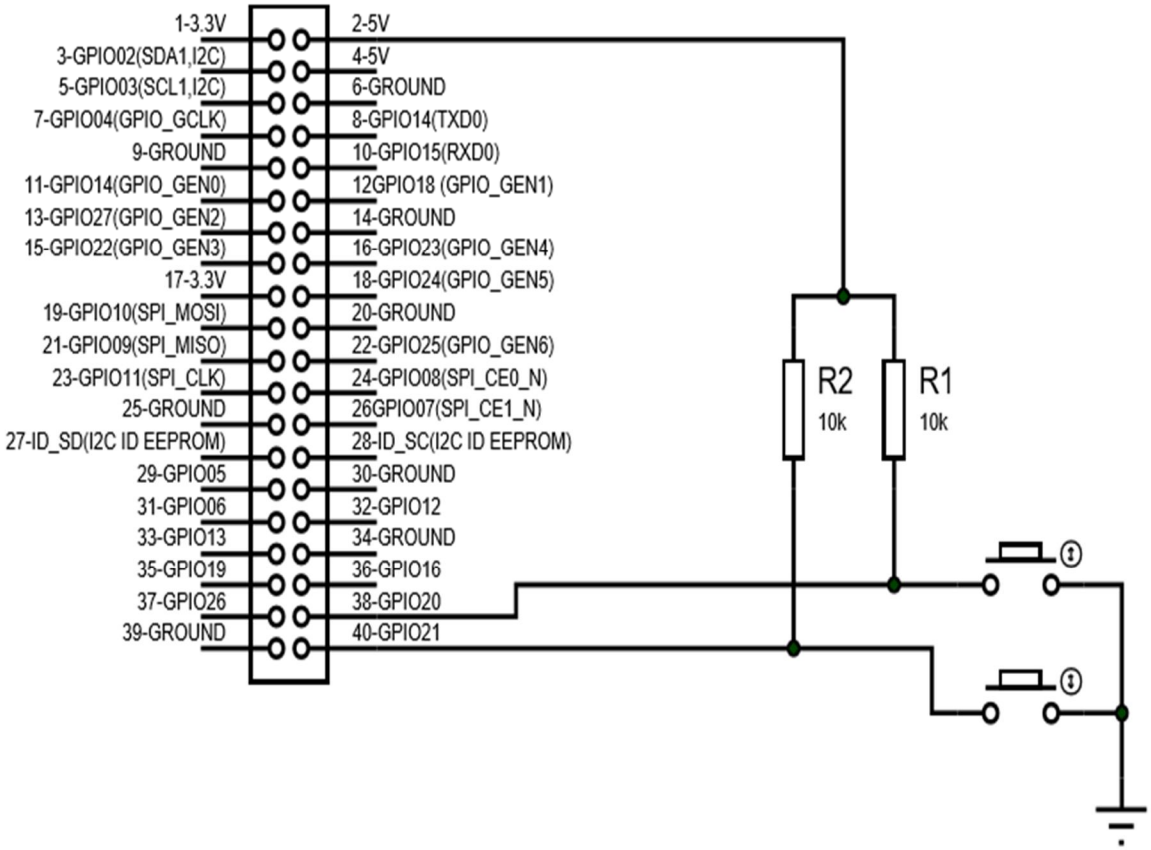


Fig.6.1.3 : Raspberry-pi connection with GPIO Pins

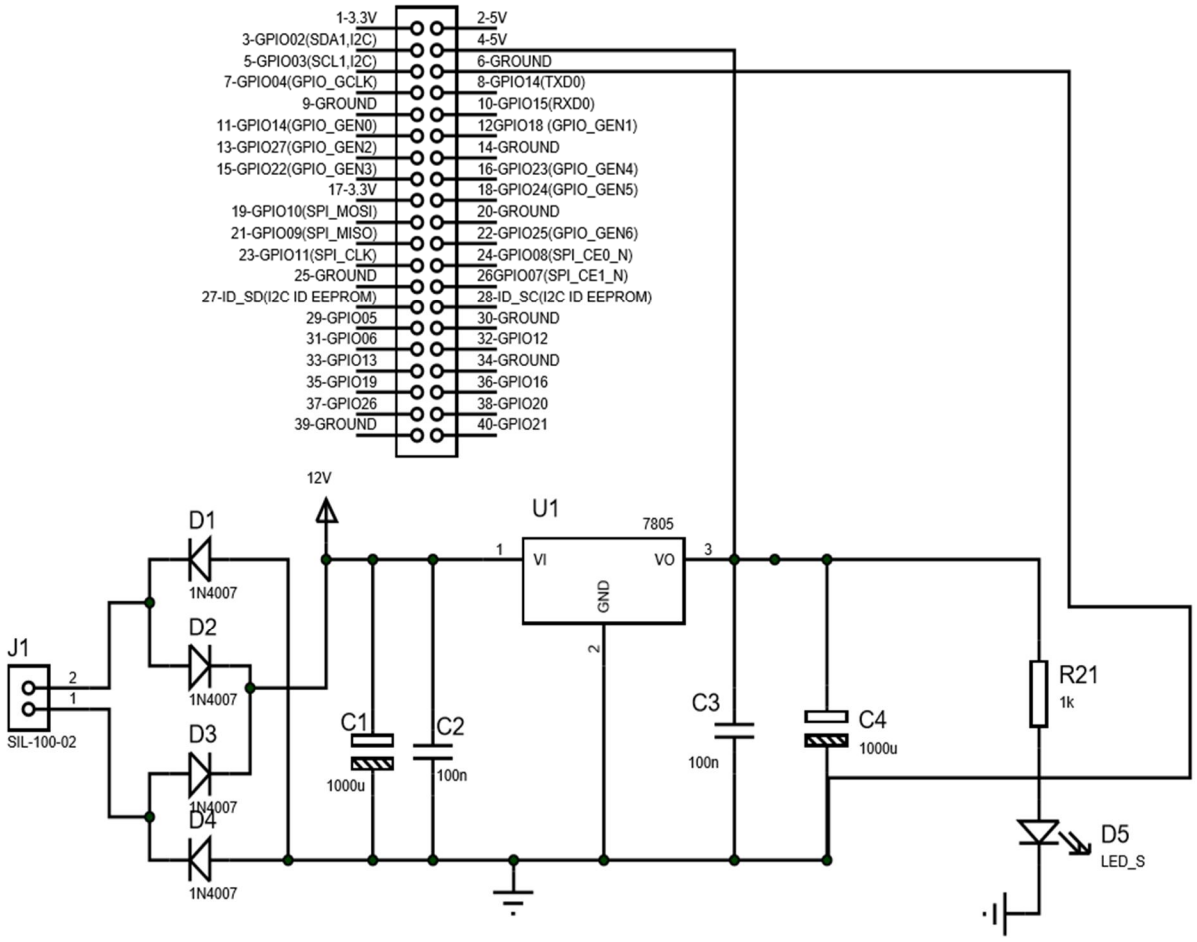


Fig.6.1.4 : Raspberry-pi connection with power supply

VI. SYSTEM SPECIFICATIONS

A. Hardware And Software Requirement

1) Hardware Requirement

Table 1 :- List of Hardware

Components	Rating	Quantity
Raspberry pi 3b+	--	1
San-disk memory card	16gb	1
GPS	--	1
GPS Antenna	--	1
Samsung WEB Cam	--	1
Registers	10k	2
Switch	--	2

2) Software Requirement

Table 2 :- List of Software

1. Win32DiskJmager
2. SD Card Formatter
3. VNC Viewer

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3) Programming Languages

a) Python: Python is one of those rare languages which can claim to be both simple and powerful. You will find yourself pleasantly surprised to see how easy it is to concentrate on the solution to the problem rather than the syntax and structure of the language you are programming in.

Features of Python

i) Simple: Python is a simple and minimalistic language. Reading a good Python program feels almost like reading English, although very strict English! This pseudo-code nature of Python is one of its greatest strengths. It allows you to concentrate on the solution to the problem rather than the language itself.

ii) Easy to Learn: As you will see, Python is extremely easy to get started with. Python has an extraordinarily simple syntax, as already mentioned.

iii) Free and Open Source: Python is an example of a *FLOSS* (Free/Libré and Open Source Software). In simple terms, you can freely distribute copies of this software, read its source code, make changes to it, and use pieces of it in new free programs. FLOSS is based on the concept of a community which shares knowledge. This is one of the reasons why Python is so good - it has been created and is constantly improved by a community who just want to see a better Python.

iv) High-level Language: When you write programs in Python, you never need to bother about the low-level details such as managing the memory used by your program, etc.

v) Portable: Due to its open-source nature, Python has been ported to (i.e. changed to make it work on) many platforms. All your Python programs can work on any of these platforms without requiring any changes at all if you are careful enough to avoid any system-dependent features. You can use Python on GNU/Linux, Windows, FreeBSD, Macintosh, Solaris, OS/2, Amiga, AROS, AS/400, BeOS, OS/390, z/OS, Palm OS, QNX, VMS, Psion, Acorn RISC OS, VxWorks, PlayStation, Sharp Zaurus, Windows CE and PocketPC! You can even use a platform like Kivy to create games for your computer *and* for iPhone, iPad, and Android.

vi) Interpreted: This requires a bit of explanation. A program written in a compiled language like C or C++ is converted from the source language i.e. C or C++ into a language that is spoken by your computer (binary code i.e. 0s and 1s) using a compiler with various flags and options. When you run the program, the linker/loader software copies the program from hard disk to memory and starts running it. Python, on the other hand, does not need compilation to binary. You just *run* the program directly from the source code. Internally, Python converts the source code into an intermediate form called byte codes and then translates this into the native language of your computer and then runs it. All this, actually, makes using Python much easier since you don't have to worry about compiling the program, making sure that the proper libraries are linked and loaded, etc. This also makes your Python programs much more portable, since you can just copy your Python program onto another computer and it just works!

vii) Object Oriented: Python supports procedure-oriented programming as well as object-oriented programming. In procedure-oriented languages, the program is built around procedures or functions which are nothing but reusable pieces of programs. In object-oriented languages, the program is built around objects which combine data and functionality. Python has a very powerful but simplistic way of doing OOP, especially when compared to big languages like C++ or Java.

viii) Extensible: If you need a critical piece of code to run very fast or want to have some piece of algorithm not to be open, you can code that part of your program in C or C++ and then use it from your Python program.

ix) Embeddable: You can embed Python within your C/C++ programs to give scripting capabilities for your program's users.

b) PHP: PHP means Personal Home Page, but it now stands for the recursive backronym PHP: Hypertext Preprocessor. PHP code may be embedded into HTML code, or it can be used in combination with various web template systems, web content management system and web frameworks. A script is a set of programming instructions that is interpreted at runtime. A scripting language is a language that interprets scripts at runtime. Scripts are usually embedded into other software environments. The purpose of the scripts is usually to enhance the performance or perform routine tasks for an application. Server side scripts are interpreted on the server while client side scripts are interpreted by the client application. PHP is a server side script that is interpreted on the server while JavaScript is an example of a client side script that is interpreted by the client browser. Both PHP and JavaScript can be embedded into HTML pages.

A PHP file can also contain tags such as HTML and client side scripts such as JavaScript.

- HTML is an added advantage when learning PHP Language. You can even learn PHP without knowing HTML but it's recommended you at least know the basics of HTML.
- Database management systems DBMS for database powered applications.
- For more advanced topics such as interactive applications and web services, you will need JavaScript and XML.

VII. ENCLOSURE DESIGN

A. Hardware In Off Condition

Fig. 8.1.1: System Hardware

B. Real Time Model

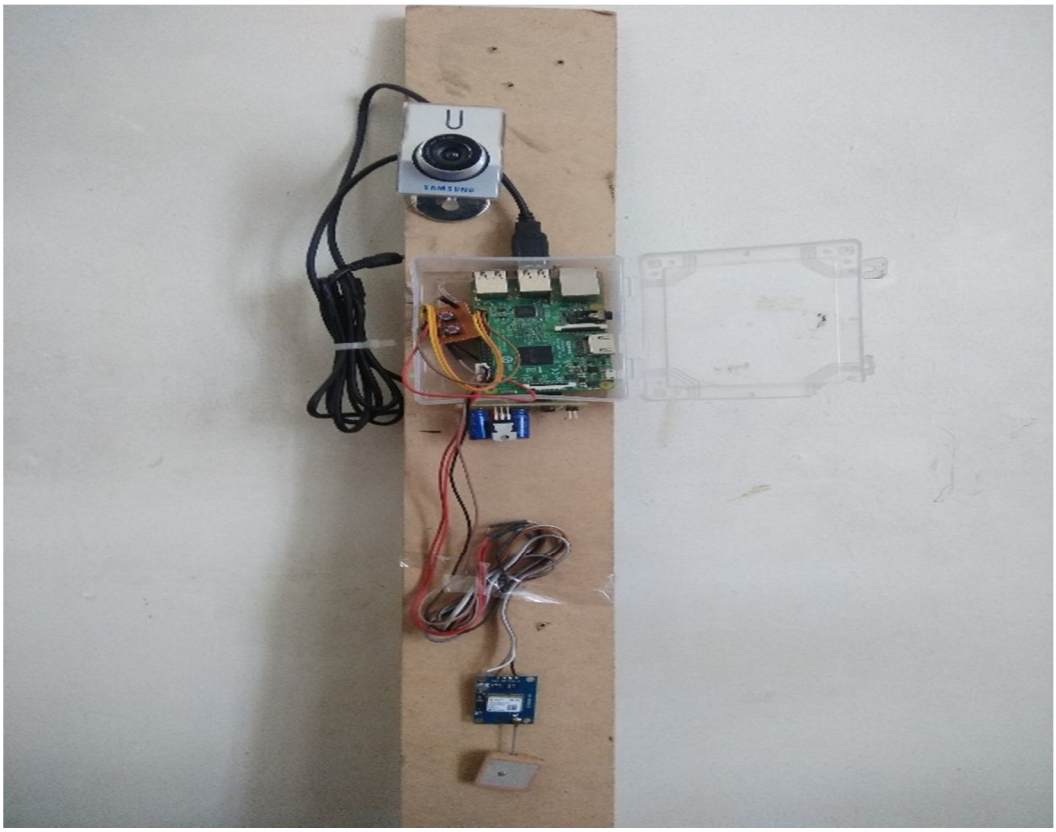


Fig. 8.1.2:Real Time Model

C. Hardware In Running Condition

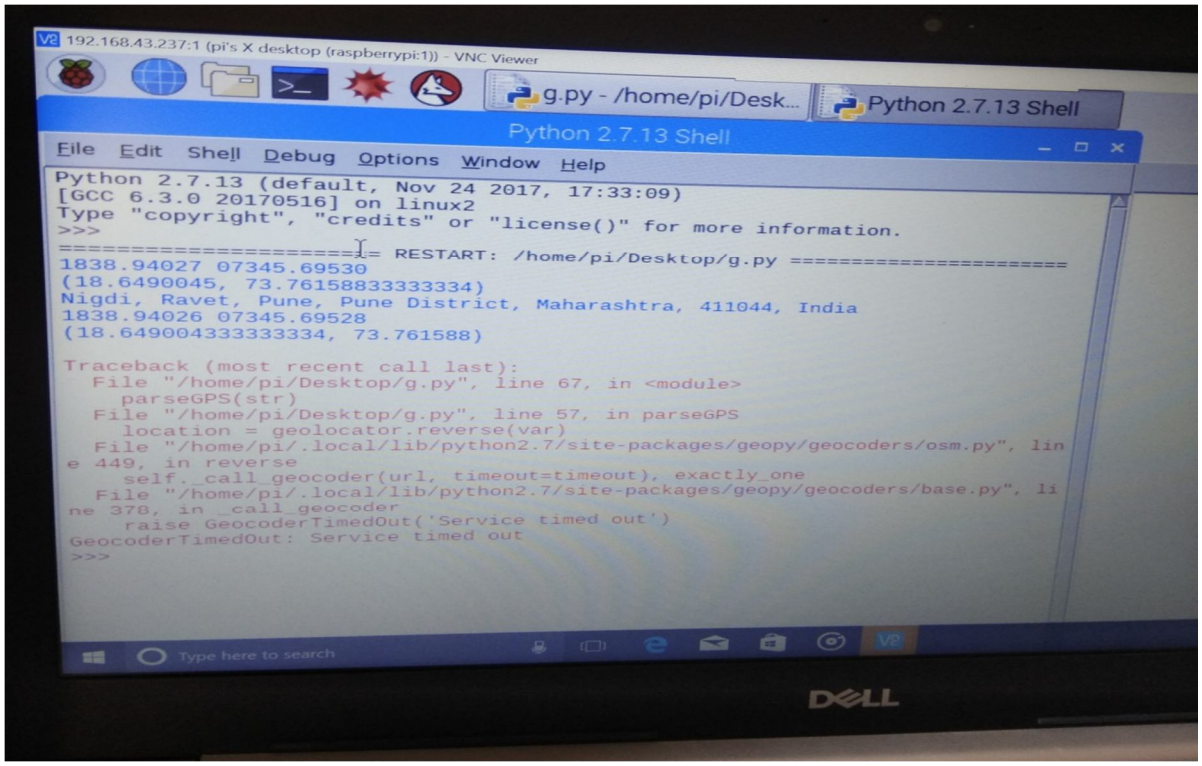


Fig. 8.1.3: System Output

VIII. CONCLUSION

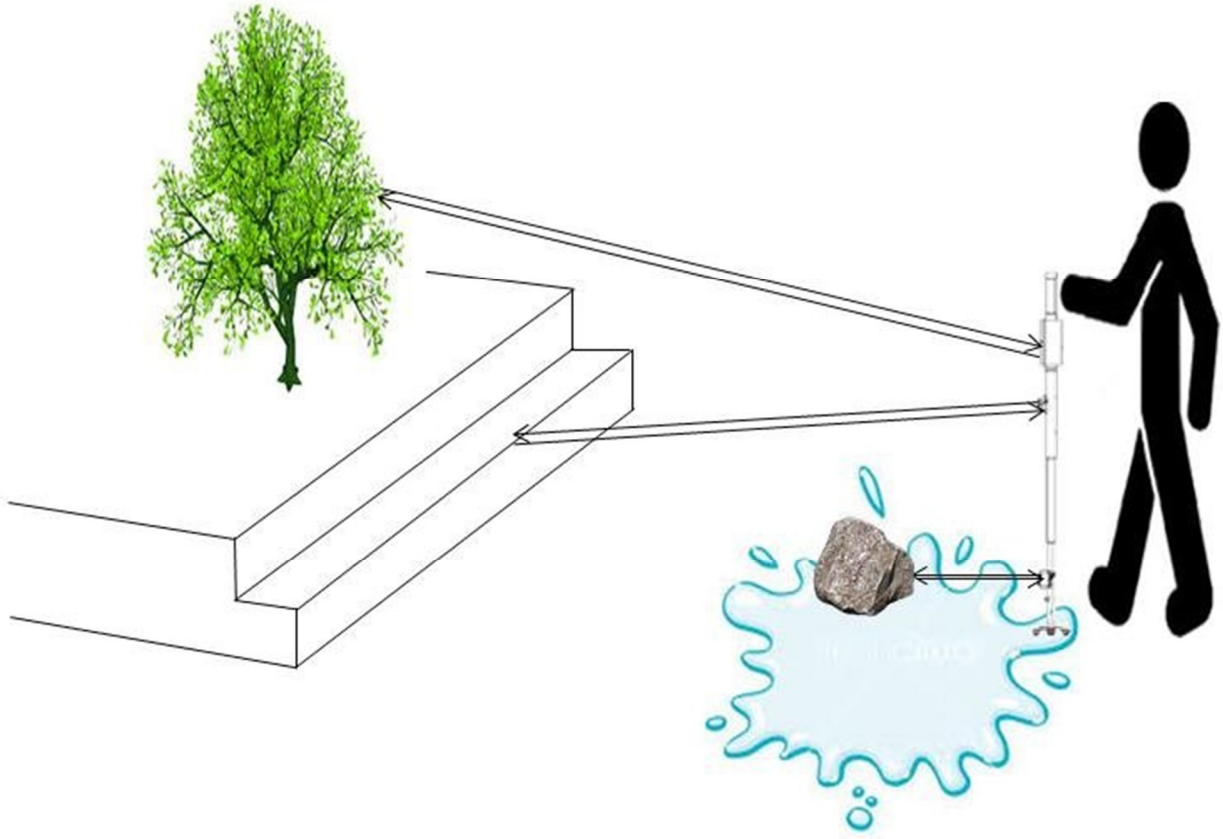
Our main aim in this whole project is to provide an assisting system to fully or partially blind people to navigate from one place to other using real-time video streaming technology and conventional sensor based technology. For further research, we can use hard-core image processing and IOT in the system to detect obstacles and decide the best path on its own.

IX. FUTURE SCOPE

All about our research we take care about one problem that is Visual disability. To make a solution we did this low cost Project. We believe that this project will spread all around Society and convert disable to able. This is our hope, to consider this stick as smart eye for the visual impairments

X. APPLICATION

Easy communication for blind people with the normal people.
For blind people to communicate, navigate and live their life efficiently.
Raspberry pi, GSM and e-SOS switch applications



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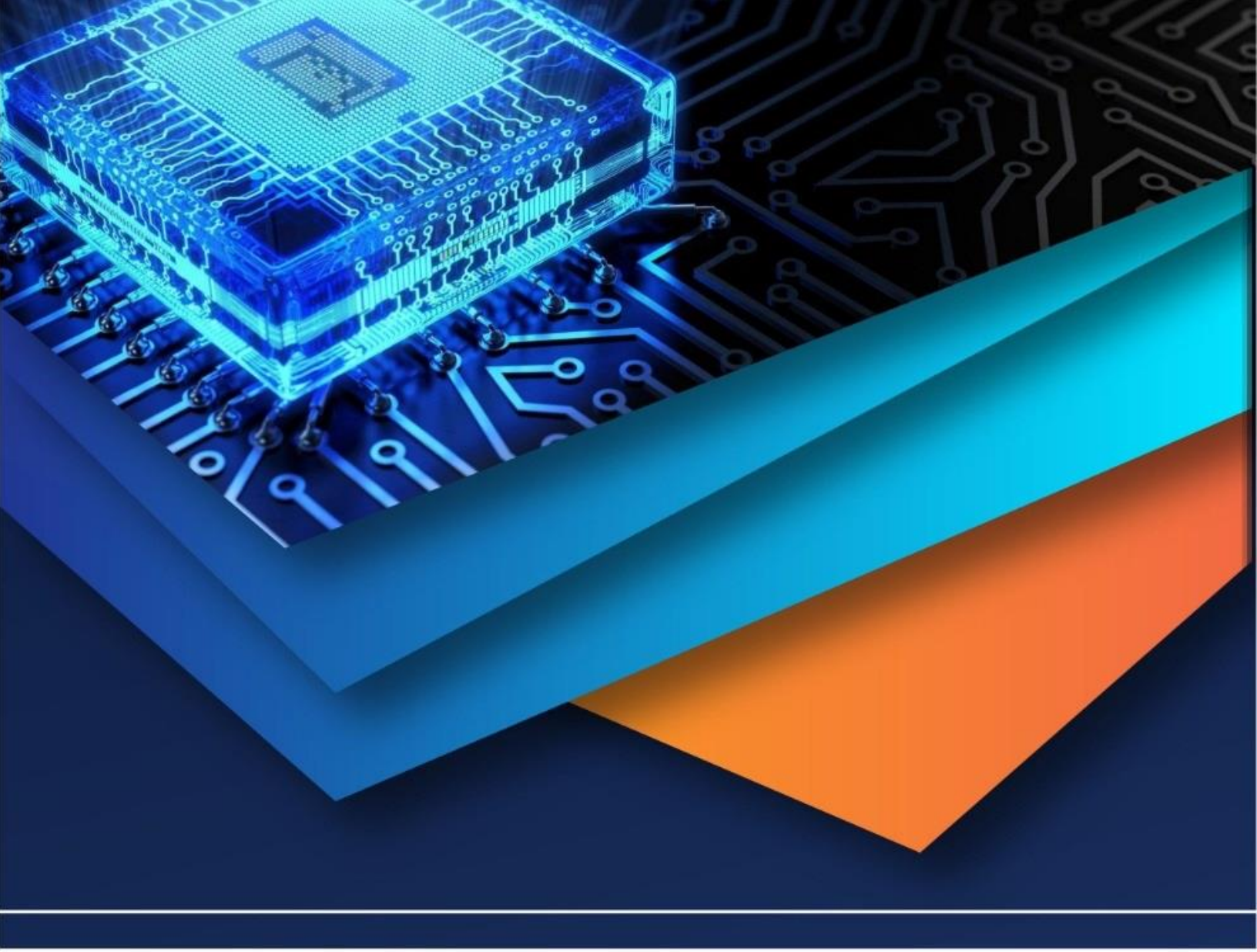

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