MAJOR PROJECT PRESENTATION

ON

IOT ROBOT

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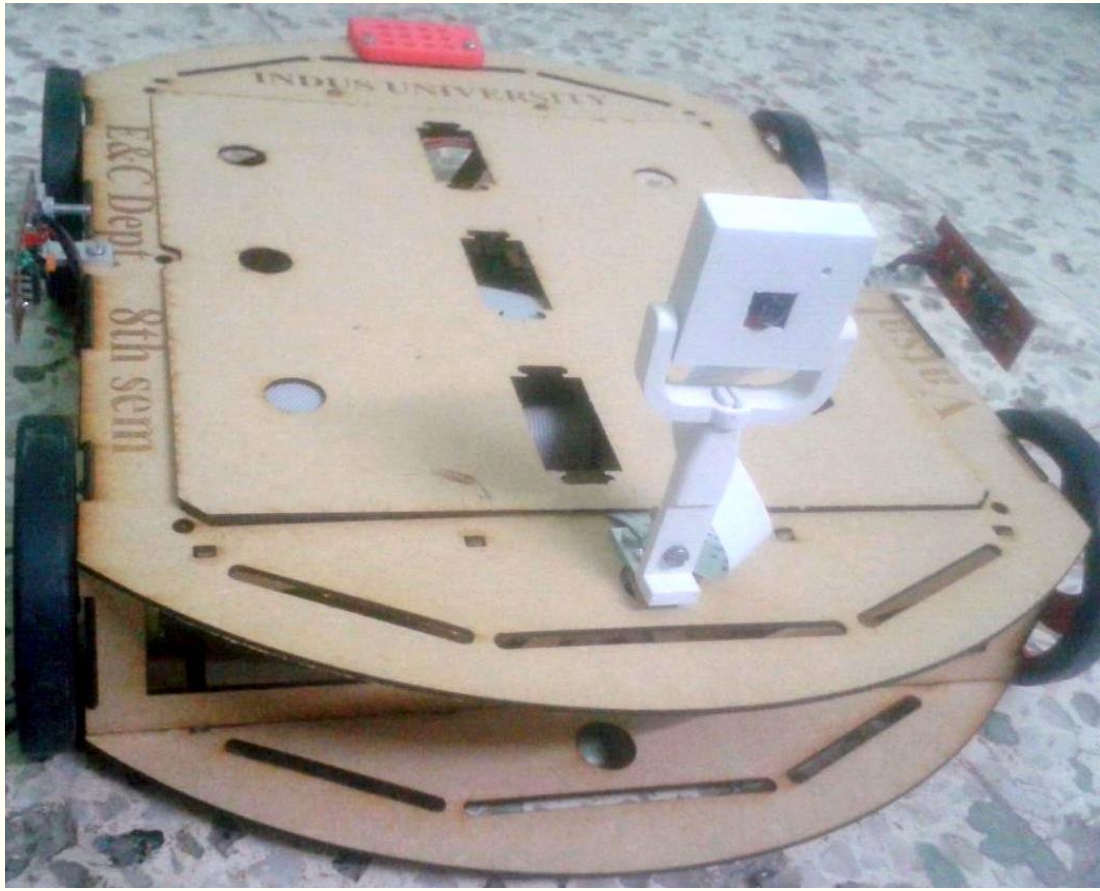
IU1241090055



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Abstract

- The Purpose Of This Project Is To Control Robot With An Interface Board Of The Raspberry Pi, Sensors And Software To Full Fill Real Time Requirement.
- Controlling DC Motors, Different Sensors, Camera Interfacing With Raspberry Pi Using Gpio Pins.
- Live Streaming, Command The Robot Easily, Sends Data Of Different Sensors Which Works Automatically Or Control From Anywhere At Any Time.
- Design Of The Website And Control Page Of Robot Is Done Using Java Tools And Html. This System Works On IOT Concept.
- This Will Enable Raspberry Pi To Be Used For More Robotic Applications And Cut Down The Cost For Building An IOT Robot.

Introduction

- **Background/Motivation:**

- Raspberry Pi Is A Credit-card Sized Computer.
- The Research And Development Of Raspberry Pi Controlled IOT Based Robot.
- IOT Is Internet Of Thing Where All The Physical Devices Connects With Digital Systems, Such As Refrigerator, TV, Ac, Washing Machine, Music System Which Can Works Automatically Or Control From Anywhere.
- Researched Says 50 Billions Devices Will Connect By 2020.
- It Is Connected With The Internet And Robot Can Be Controlled As Per Given Command.

- **Technology:**

- The Technologies Used In The Project Are Java, HTML, Java Script, JSP, Ajex, JSP & Servlet.
- It Uses The Wireless Technology To Communication Between Raspberry Pi And User Interface.

Objective

To develop an IOT technology based robot, which can be controlled by a mobile devices/ computer over the Internet / Wi-Fi from anywhere at any time.

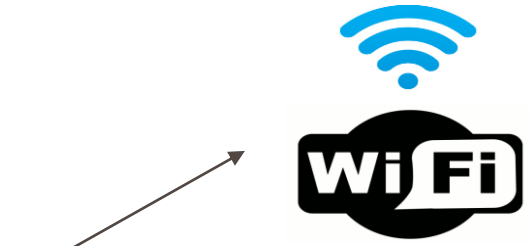
- Gather system requirements
- Evaluate and study the platform required for the system
- Evaluate and study suitable development language, technologies and tools
- Evaluate Methods of Interface
- Program Raspberry Pi
- Interface board for dc motors
- Program Website & Control Page
- Evaluate and test the system
- Maintain system

Design Methodology

- The design consists more on actual planning of hardware part than the code to be created. A number of software and hardware implementation techniques were used to design and develop the system. Fig. 1 shows the block diagram of system.
- This section can be divided into many parts: Raspberry pi controller, Wifi dongle, Camera design, Power supply adapter, Ultrasonic sensor, IR sensors, and Motor control design.

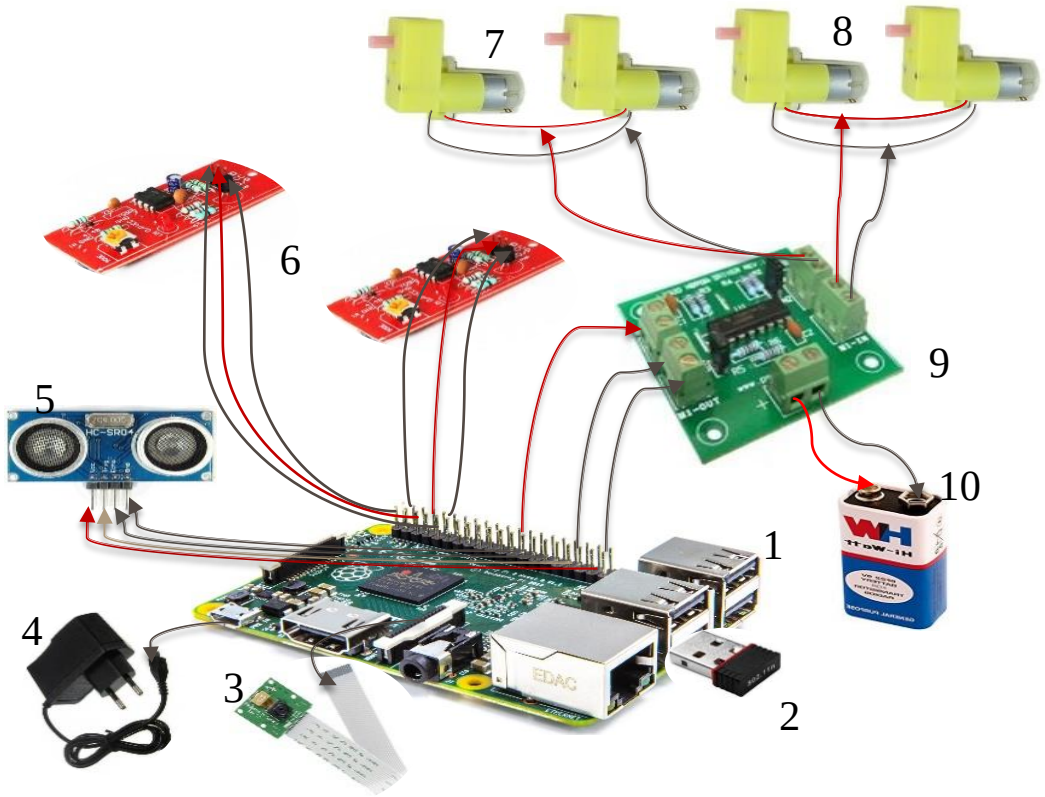
Block Diagram

No.	Item	No	Item
1	Raspberry Pi 2	7	Left Side DC Motor
2	Wifi Dongle	8	Right Side DC Motor
3	Raspberry Pi Camera	9	L293D Motor Driver Board
4	5V Adapter	10	9V Battery
5	Ultrasonic Sensor	11	Control from different devices
6	IR Sensors	12	User Interface to Control Robot



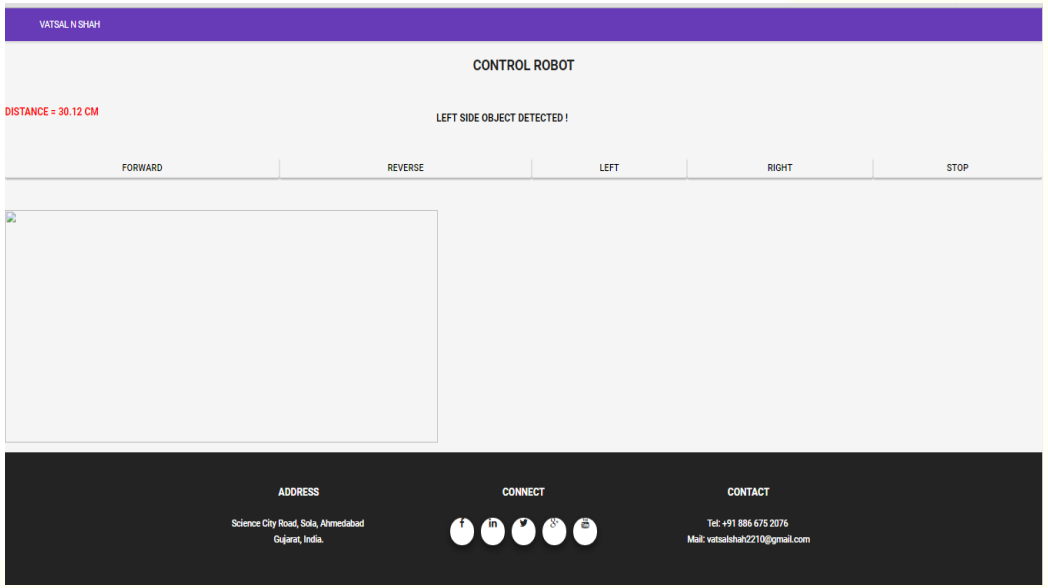
Server

(Raspberry Pi)



Client

(browser on any device connected to the same WiFi network as the Raspberry Pi)

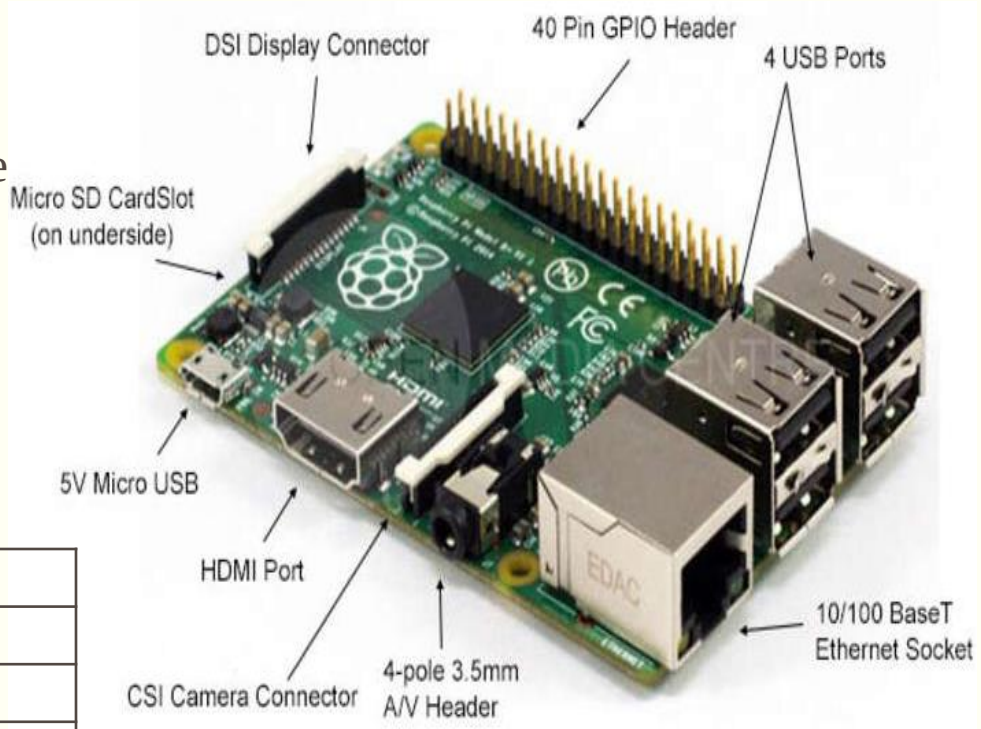


Components Details

1. Raspberry pi 2:

The Micro SD card is used for installing OS and the complete project will be done with python coding.

The board has specification:



A 900MHz quad-core ARM Cortex-A7 CPU	4 USB ports
1GB RAM	Full HDMI port
40 GPIO pins	Display Interface
Ethernet Port	Micro SD card Slot
Combined 3.5mm audio jack and composite video	Video core IV 3D graphics core
Camera Interface	

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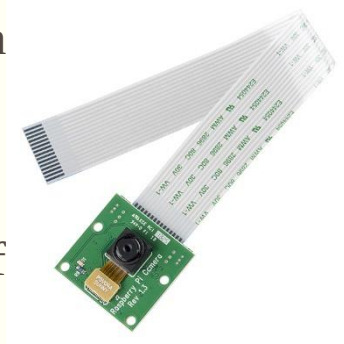
2. WiFi Dongle

- Its 150Mbps Nano USB adapter. Wireless-N USB adapter is used to connect Raspberry Pi with Internet. Standards are IEEE 802.11n, 802.11g, 802.11b and frequency range is 2.4 GHz.
- Support the systems as XP, Vista, WIN 7, WIN 8, and Linux.

3. Raspberry Pi Camera



- The Raspberry Pi camera board contains a 5 MPixel sensor, and connects via a ribbon cable to the CSI connector on the Raspberry Pi.
- In Raspbian support can be enabled by the installing or upgrading to the latest version of the OS and then running Raspi-config and selecting the camera option.

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4. 5V Adapter Power Supply

- Raspberry Pi require power source to turn it on. 5V adapter Power supply is enough to power up. In project I connect Power bank with raspberry Pi, so that it can be put easily in structure.

5. Ultrasonic Sensor

- This sensor is a high performance ultrasonic range finder.
- It is compact and measures an amazingly wide range from 2cm to 4m.
- This ranger is a perfect for any robotic application, or any other projects requiring accurate ranging information.

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6. IR Sensor

- The sensor consists of two eyes.
- One eye sends the infrared light and the other eye sees the reflection of that infrared light and measures the distance which is then sent to the Raspberry Pi to perform further operations based on the distance.

7. DC Motor

- Almost every mechanical movement that we see around us is accomplished by an electric motor.
- Electric machines are means of converting conventional energy. Motors take electrical energy and produce mechanical energy.

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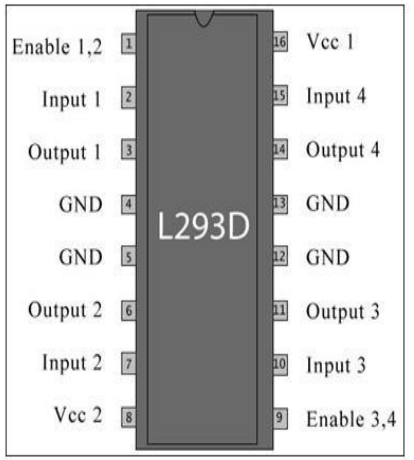
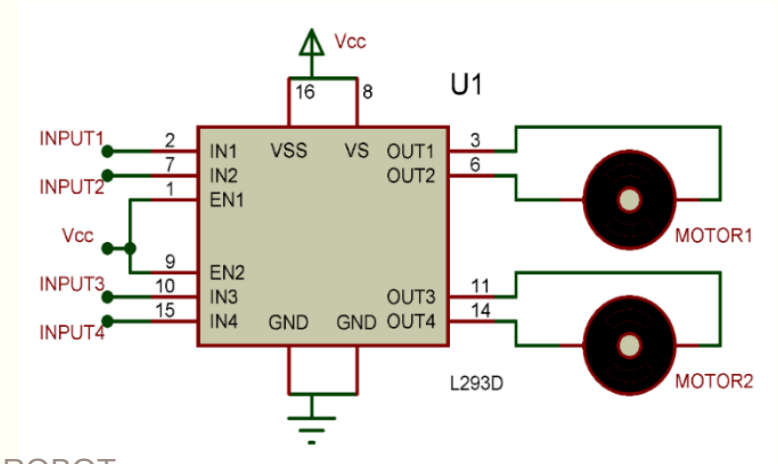
8. L293D Motor Driver IC

- A very easy and safe is to use popular L293D chip. It is a 16- pin chip.
- The L293D is designed to provide bidirectional drive currents of up to 600-mA at voltages from 4.5 V to 36 V.
- The dc motor and L293D IC has been connected according to the circuit schematic as shown has been designed using Proteus 7.



Direction	Motor 1		Motor 2	
	Input 1	Input 2	Input 3	Input 4
Forward	High	Low	High	Low
Reverse	Low	High	Low	High
Left	High	Low	Low	High
Right	Low	High	High	Low



Comparison of Raspberry Pi other Competitor

Name	Arduino Uno	Raspberry Pi	BeagleBone
Model Tested	R3	Model B	Rev A5
Price	$29.95	$35	$89
Size	2.95"x2.10"	3.37"x2.125"	3.4"x2.1"
Processor	ATMega 328	ARM11	ARM Cortex-A8
Clock Speed	16MHz	700MHz	700MHz
RAM	2KB	256MB	256MB
Flash	32KB	(SD Card)	4GB(microSD)
EEPROM	1KB		
Input Voltage	7-12v	5v	5v
Min Power	42mA (.3W)	700mA (3.5W)	170mA (.85W)
Digital GPIO	14	8	66
Analog Input	6 10-bit	N/A	7 12-bit
PWM	6		8
TWI/I2C	2	1	2
SPI	1	1	1
UART	1	1	5
Dev IDE	Arduino Tool	IDLE, Scratch, Squeak/Linux	Python, Scratch, Squeak, Cloud9/Linux
Ethernet	N/A	10/100	10/100
USB Master	N/A	2 USB 2.0	1 USB 2.0
Video Out	N/A	HDMI, Composite	N/A
Audio Output	N/A	HDMI, Analog	Analog

Advantages of Raspberry Pi

- This microcomputer is useful for small or home based businesses that run on a smaller budget than bigger companies for you are not required to purchase any special licenses from the Raspberry Pi Foundation to use their product or if you invent new technology that embeds the product.
- The product does not require the user to have extensive programming experience since it is aimed for the younger generation to learn about programming. Python, the programming language that the Pi uses, is less complex than other languages available.
- The SD cards on the board can be easily switched, which allows you to change the functions of the device without spending a lot of time re-installing the software.
- The Raspberry Pi is perfect for adaptive technology: it is able to display images or play videos at 1080p high definition resolution. This product makes it possible to build complex and effective products at a cheaper price.

Disadvantages of Raspberry Pi

- It does not replace your computer, since the Ethernet is only a 10/100 and the processor is not as fast, it is time consuming to download and install software and is unable to do any complex multitasking.
- Not compatible with other operating systems such as Windows (There are currently 1.3 billion Windows users around the world.)
- This product will not be useful for bigger businesses that already have big servers, which would already do everything that the Raspberry Pi does, so it would not be worth it to take the time to get someone to put it together.

Tools Used


eclipse


JavaScript


JSP & Servlet


jQuery

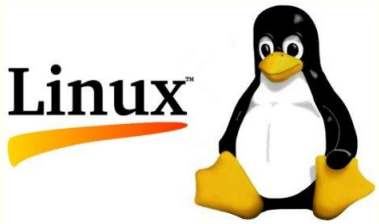

HTML


CSS


AJAX


MySQL®


The Pi4J Project
Connecting Java to the Raspberry Pi


Linux


Apache
Tomcat


MobaXterm


WinSCP

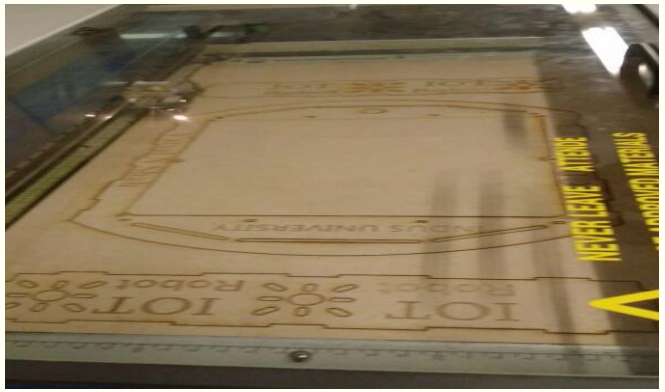

Rhinoceros®
modeling tools for designers

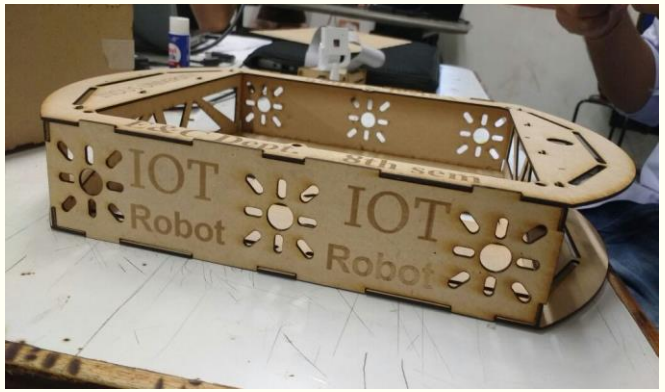

Cura
Powered by Ultimaker

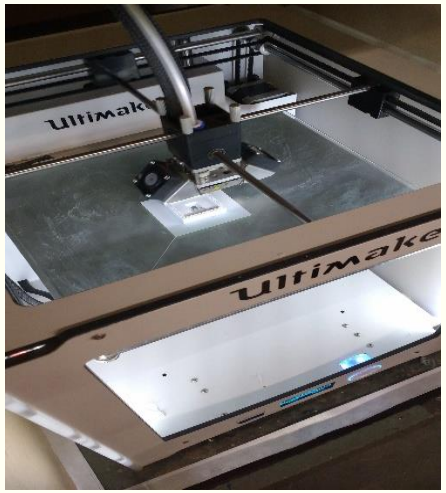

PuTTY

Implemented System

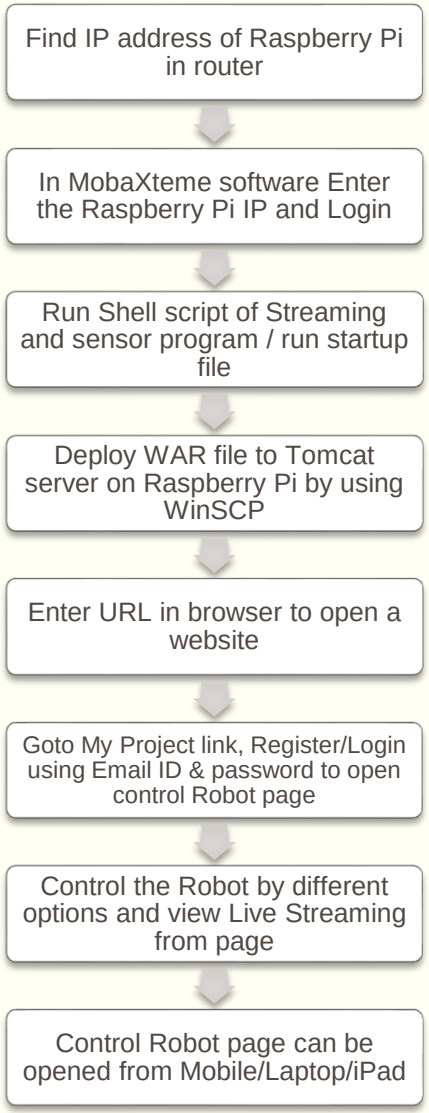
- The system is implemented with Laser cutting tool and 3D printing tool.
- Robot chassis is designed with Laser cutting and Ultrasonic sensor and Camera case is designed with 3D priming.
- Using machine Ultimaker 2 case of Raspberry Pi camera is designed and working with it is shown below.
- The full body requires time around 1 hours to print it.







Setup

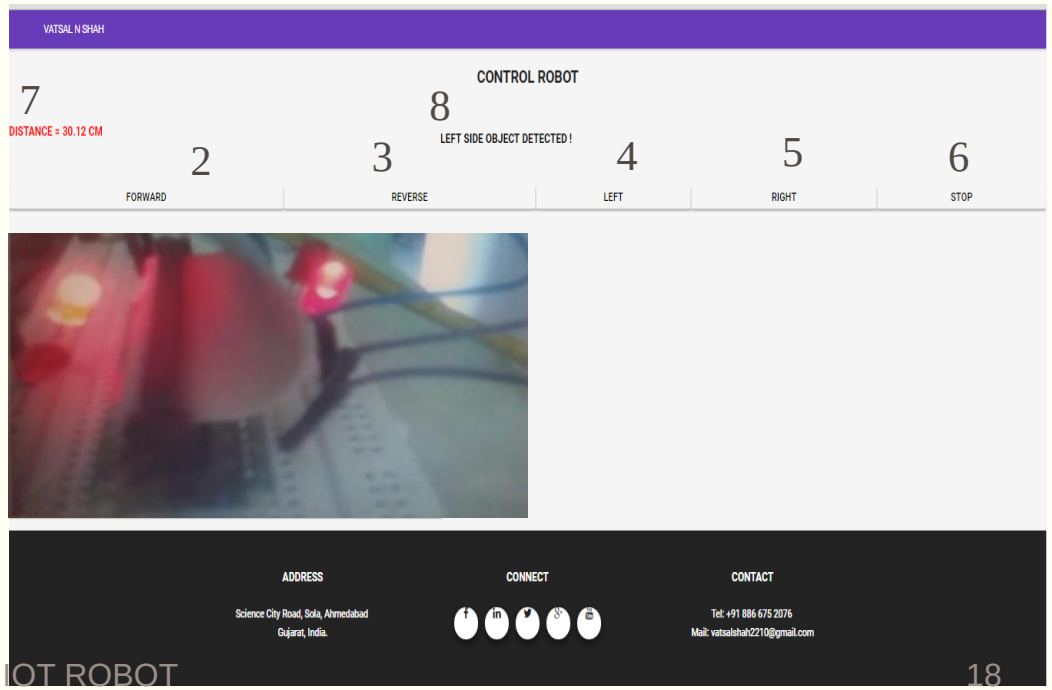


Flow Chart

- The flow chart describe the necessary steps to execute once in the beginning, then when the Raspberry Pi turn on all the compilation files and video streaming file execute at its own using startup.sh file.

Results

No.	Test case description	Test Result
1	Webcam Video display	Accepted
2	Move Forward	Accepted
3	Move Reverse	Accepted
4	Turn Left	Accepted
5	Turn Right	Accepted
6	Stop	Accepted
7	Ultrasonic sensor reading	Accepted
8	IR Sensor reading	Accepted



Conclusion

- During the course of the project I gained knowledge of Java I also gained knowledge of the Raspberry Pi technology and what the small computer is capable of.
- After knowing the capabilities of raspberry pi and the applications it could have in the field of robotics, and IOT it actually has made me to think of doing more research work on the raspberry pi for the robotic and IOT applications.
- The challenges that I faced during the course of the project were that of the time constrain, as I had to learn about the raspberry pi and then learn programming in Java and HTML.
- Then during the programming of the server client interfaces the problems of calling functions with a button press.
- One of the main challenges that No output comes when some functions are called from software side.
- If given an opportunity to work again on the same technology i.e. the raspberry pi and IOT technology or on a project like this where the raspberry pi is used for any kind off application I would be happy to take it up.

Future Work

- In the future this technology can be used in various different fields of work.
- The robot can be made autonomous with the help of more sensor, gyroscope, compass and a GPS. So that it can be set to a target or a specific area where in can monitor.
- Adding the Pneumatics design in Mechanical so robot can go up and down, can hold the object.
- Face recognition: The robot will recognize the face images which are stored in controller and generate the alert if doesn't match.
- By making above changes robot can do more functions as Open the door, Turn on/off switch, bring newspaper for user, etc.

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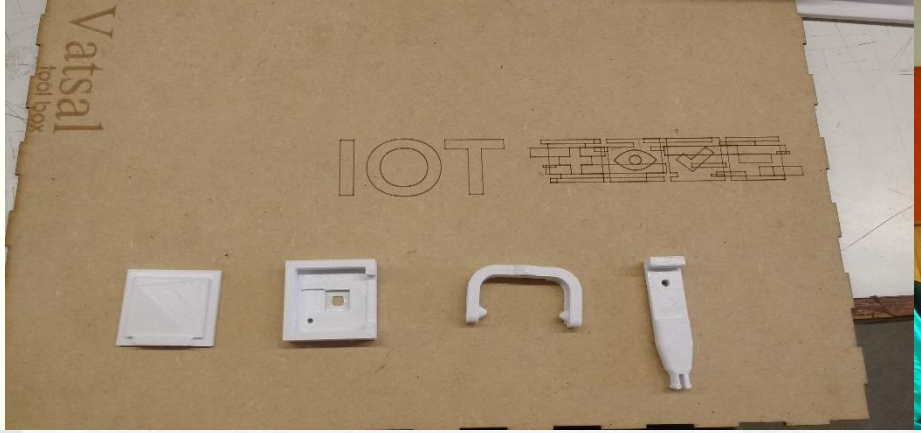


city ANCHOR

ઈન્ડસ યુનિ.માં ઈલેક્ટ્રોનિક એન્ડ કોમ્યુનિકેશન એન્જિનિયરિંગમાં અભ્યાસ કરનારા વિદ્યાર્થીનું સંશોધન

બહેનોની સુરક્ષા માટે બનાવ્યો IOT રોબોટ

ઈન્ડસ યુનિવર્સિટીના ઈલેક્ટ્રોનિક એન્ડ કોમ્યુનિકેશન એન્જિનિયરિંગના સેમેસ્ટર ૪માં અભ્યાસ કરતા વત્સલ શાહે ભવિષ્યની અત્યંત એડવાન્સ ટેકનોલોજીનો ઉપયોગ કરીને 'આઈઓટી રોબોટ'તૈયાર કર્યો છે. ક્યારેક ઘરે એકલી રહેતી બે નાની બહેનોની સુરક્ષાનું ધ્યાન રાખી શકાય એ હેતુથી તૈયાર કરેલા આ રોબોટમાં વત્સલ હજુ ઘણા ડેવલપમેન્ટ કરવાનો છે. હ્યુમન બોડી તૈયાર થયા બાદ આ રોબોટ મહેમાનો માટે ઘરના દરવાજા પણ ખોલી આપશે.

સિટી રિપોર્ટર @ahm_cb

વત્સલ કહે છે, 'મારે બે નાની ટ્વિન બહેનો છે. તેઓ ઘણી વાર ઘરમાં એકલી હોય છે. એ સમયમાં તેમની સુરક્ષાના કારણોસર ઘરમાં નજર રાખી શકાય એ હેતુથી મેં આ રોબોટ તૈયાર કર્યો છે. પરંતુ મેં રોબોટ ઘર ઉપરાંત, ઈન્ડસ્ટ્રી અને હોસ્પિટલમાં પણ ઉપયોગ કરી શકાય તે રીતે ડિઝાઈન કર્યો છે. જોકે, હું હજુ આમા ઘણુ ઈમ્પ્રોવાઈઝેશન કરવાનો છું. હાલ તેને લેસર કટિંગની ટેકનોલોજીથી વુડન બોડીથી બોક્સ ડિઝાઈનમાં તૈયાર કર્યો છે. જે હ્યુમન બોડીમાં ડિઝાઈન થયા બાદ તે ઘરમાં મહેમાન આવ્યા હોય તો સૂચના આપવાથી દરવાજો પણ ખોલી શકશે. હોસ્પિટલમાં જ્યારે પેશન્ટની મિનિટે મિનિટની સ્થિતિનું ધ્યાન રાખવાનું હોય તે કરી શકે અને જરૂર પડે તો ડોક્ટરને પણ જાણ કરી શકે એ રીતે આ રોબોટ કામ કરી શકશે. તેમાં રાસબેરી પાઈ કંટ્રોલર છે, જેને એચડીએમઆઈ કેબલ સાથે જોડીને ટીવીમાં પણ ઘરની એક્ટિવિટીઝ જોઈ શકાય છે.'

ભવિષ્યના ફ્રિજ જાતે જ શાકભાજીનો ઓર્ડર આપી દેશે

ભવિષ્યમાં ટી.વી.-એ.સી.થી માંડી ફ્રિજ સુધીના તમામ ફિઝીકલ ડિવાઈસ ઈન્ટરનેટ ઓફ થિંગ્સ ટેકનોલોજીથી બનશે. ફ્રિજ એવા આવશે જેમાં શાકભાજી પતી જાય તો ફ્રિજ જાતે જ નેટ પર નવા શાકભાજીનો ઓર્ડર આપી દેશે અને બીજા દિવસે ઘરે શાકભાજી પહોંચી જશે. • વત્સલ

પોતે વિકસાવેલા આઈઓટી રોબોટ સાથે વત્સલ શાહ

શું છે IOT ટેકનોલોજી

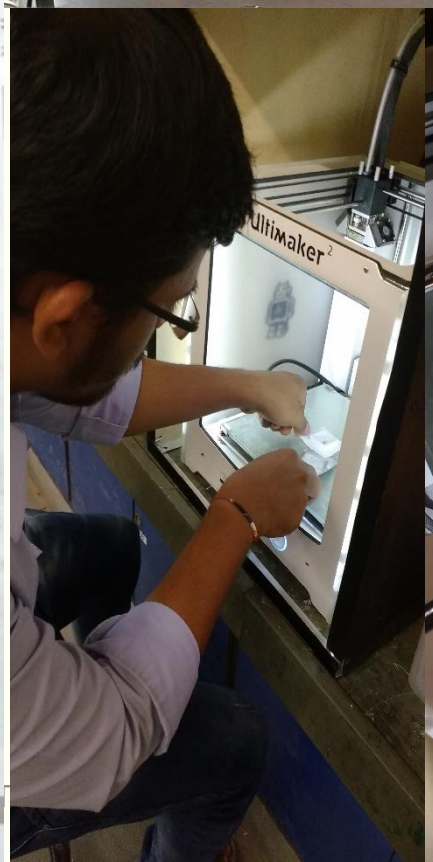
આઈઓટી એટલે 'ઈન્ટરનેટ ઓફ થિંગ્સ'. તે આવનારી પેઢીની અત્યંત એડવાન્સ ટેકનોલોજી છે. જેમાં ફિઝીકલ ડિવાઈસને ઈન્ટરનેટની સાથે કનેક્ટ કરવામાં આવે છે.

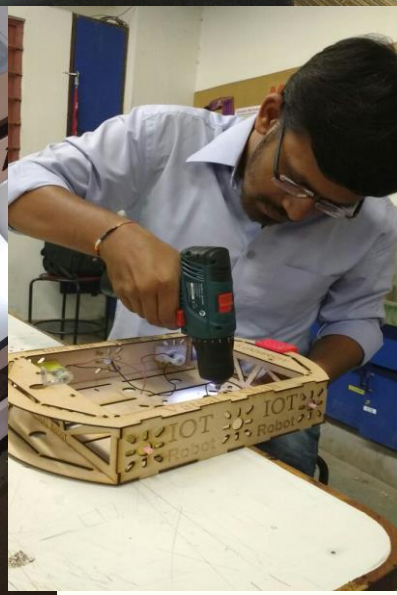
કેવી રીતે કામ કરે છે

રોબોટની ફિઝિકલ બોડીની સાથે ઈન્ટરનેટ કનેક્ટિવિટી માટે વત્સલે એક વેબસાઈટ અને મોબાઈલ એપ તૈયાર કરી છે. જેનાથી તેનું મોનિટરિંગ કરી શકાય છે. નજીક કે દૂરની વ્યક્તિ કે વસ્તુનું અંતર જણાવવા ઉપરાંત આ રોબોટ ઘરમાં થતી હલચલના નોટિફિકેશન પણ આપે છે.

IOT રોબોટના સ્પેસિફિકેશન્સ

- નાઈટ વિઝન સાથેનો 5 MP કેમેરા
- વોઈસ કંટ્રોલર
- પાસેની વ્યક્તિ-વસ્તુનું અંતર બતાવતા ખાસ સેન્સર્સ
- કંટ્રોલિંગના પેઈજ-મોબાઈલ એપમાં નોટિફિકેશન્સ બતાવે
- ચોક્કસ વિન્ડોમાં સેન્સરનો ડેટા દર્શાવે છે






time for questions

Thank You All

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