IJDCST @ July-Aug-2017, Issue- V-5, I-5, SW-15
ISSN-2320-7884 (Online)
ISSN-2321-0257 (Print)

Raspberry Pi3 Based Wireless Controlled Robot in Disaster Zones for the Detection of Human Presence

S. Bharath[1], M. Srinivasa Rao [2], Dr. D.Nagendra Rao[3]
[1] M.Tech Student, Joginpally B.R. Engineering College, Moinabad, Hyderabad Telangana, India,
[2]Associate Prof, Head of Dept of ECE, Joginpally B.R. Engineering College, Moinabad, Hyderabad Telangana, India,
[3]Professor, Department of ECE, D.R.K. Engineering College, Bowrampet, Hyderabad, Telangana, India.

Abstract: The main aim of this project is to control the robot wirelessly using WIFI and simultaneously to stream the live video to know the human presence in disaster zones. A PIR sensor is used to detect the human body which will emit IR radiation when alive. The major modules used in the project are Raspberry Pi3, USB camera, PIR sensor, ultra sonic sensor, two dc motors to run the robot along with its driver board. Once the robot is placed in the disaster zone PIR sensor starts its operation and on detection of the live body it triggers the buzzer which is attached on the robot and to confirm whether it is human body or some other object we can have live streaming video from the USB camera on the display. Ultrasonic sensor is used here to know the distance of the object from robot.

To run the robot two dc motors each of 9v is used in order to control the direction of the robot, L293D driver IC which use H-bridge operation is used. The raspberry Pi3 used here is of B+ which has inbuilt WIFI and blue tooth so that we can make full use of all other USB ports to attach other modules.

Keywords: Raspberry Pi3, PIR sensor, Ultrasonic sensor, USB camera, Python and Wiring Pi.

I.INTRODUCTION

Building collapse, bomb explosions and natural calamities like Tsunami and earthquake are often occur and cannot be stopped by humans even with much advanced technology in today's world.

In such disasters we see many of the bodies will be trapped under such collapses and rescue teams and firefighters take much risk and try to save them. But there is a chance that even with such great effort by the rescue teams, the found bodies may be alive or in dead state which in turn a waste of precious time of the rescue teams which can be utilized in saving other live bodies. So in such critical conditions to assist rescue teams this project comes very handy. It takes care to confirm whether the human or any other body is alive or not and inform the same to the rescue teams so that they can take appropriate action on time. Previous system uses controlling the robot using LM-328 micro controller and Bluetooth wireless technology which has a limitation in distance and performance.

To overcome such problem this project was designed using high performance Raspberry Pi3 which is a credit-card sized single board minicomputer and the wireless technology used is Wi-Fi which can cover much long distance.

II.HARDWARE DESCRIPTION

A) Block Diagram:

The project Raspberry Pi3 based wireless controlled operated robot in disaster zones for the detection of human presence contains the blocks as shown in figure 1 . It contains both robot section and control section.

Robot Section

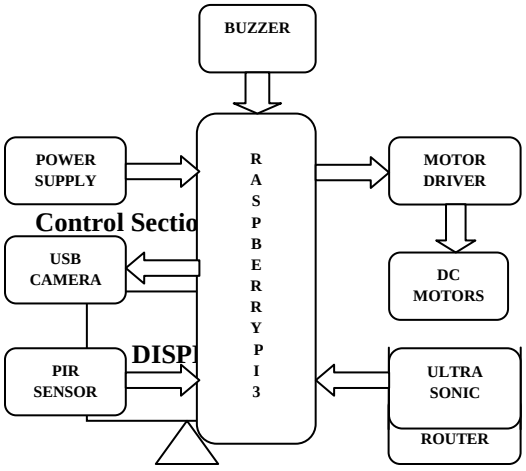


Fig 1: Block diagram

Control section is used to operate the robot and give appropriate directions to run it and also used to monitor the location in the display/PC.

B) Individual Blocks:

a) Main module used in the project is Raspberry pi 3 which is a credit card sized minicomputer with high performance and reasonable cost. The main advantage of this Pi board is it comes with inbuilt on board Wi-Fi and Bluetooth which is an added advantage. It comes with 1GB SDRAM@400Mhz and Quad core processor with 1.2 GHz speed.

Fig 2: Raspberry Pi3

b) Next important module is the PIR sensor which is used to detection the human presence in the project. It consists of three pins namely vcc, out and Gnd pin. The range of the device varies from application and also depends on environment it is been operating.

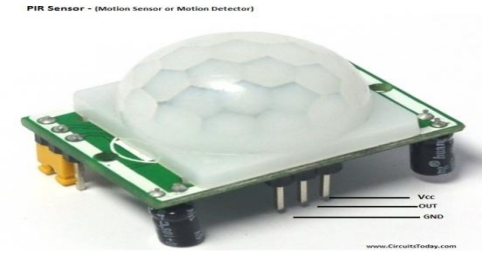


Fig 3: PIR sensor

c) The USB cam used here is to have the live streaming of the location and also used to confirm the human presence. The cam used in the project is directly connected to Pi board via USB port and can be accessed by entering its IP address.

Fig 4: USB Camera

d) Ultrasonic sensor is been used in the project to measure the distance from the object to the robot. The maximum range it can measure is 4m.

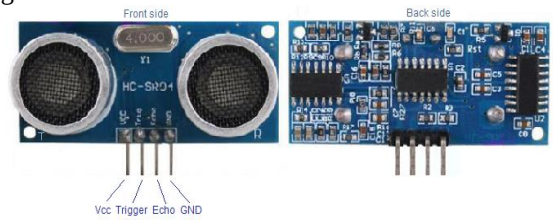


Fig 5: ultrasonic sensor

e) Wi-Fi router used in the project is to create a hotspot so that the Raspberry Pi and the PC gets connected via a network and can be operated to control the robot in the field. The maximum range is 150m in this case.

Fig 6: Wi-Fi Router

III.IMPLEMENTATION & RESULTS

A) Hardware Modules required:

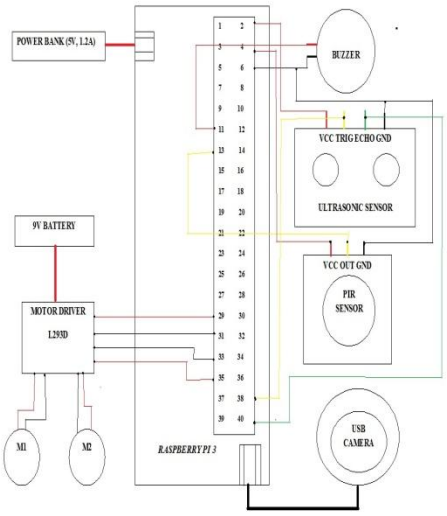
1) Raspberry Pi 3: Model B+, 1GB SD RAM, 1.2 GHz
2) SD card: 16 GB/80Mbps
3) PIR sensor: 3.3v, 120^0 angle, 5-8sec delay
4) Ultra sonic sensor: 5v, 4 mtrs, 15^0 angle
5) USB cam: 20 mega pixel
6) DC motors: 3-9 v range
7) Motor driver: L293D
8) Wi-Fi router: 150-300 mtrs range
9) Power bank : 5V/1.5A for Pi board
10) Rechargeable battery: 9v for motors

B) Software tools required:

1) Raspbian OS: Jessie
2) Python: Latest version
3) Wiring Pi library
4) Motion library package for Camera

C) Schematic Diagram:

Schematic diagram of the project is shown in fig 7, with all the connections.



1) Motors are connected to the pins 29, 31, 33 and 35
2) PIR sensor pins 13, GND
3) Ultra sonic sensor pins 38, 40, VCC and GND
4) Buzzer pins 11 and GND
5) CAM using USB port.

D) Robot section after assembling

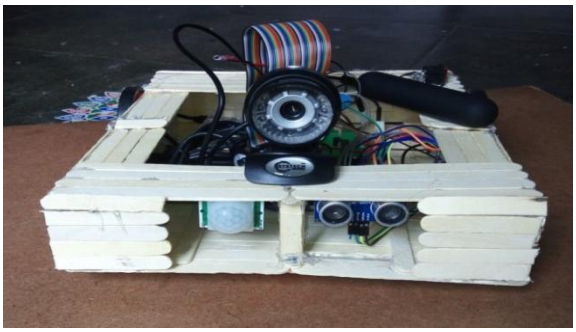


Fig 8(a): Front view

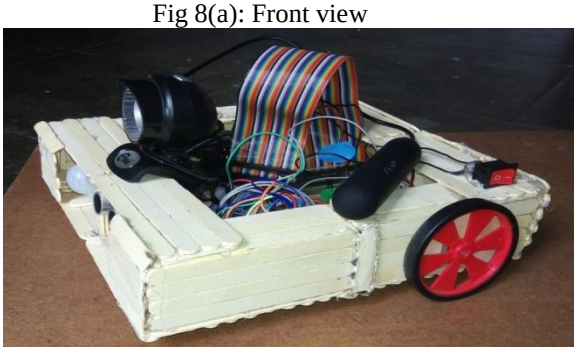


Fig 8(b): Side view

Fig 8: Assembled Robot

The above figure 8 shows the assembled robot in which all the components shown in the figure 8 are placed and given proper connections. The front view is shown in fig 8(a), and the side view in fig 8(b) of the complete robot.

E) Robot and control section in OFF state

Fig 9: Robot and control section in OFF state

The above fig 9 shows the project that is the robot section and the control section before action. To run the robot we need to provide power supply to the Pi board which is done using power bank and for motors using external power supply which should be around 9V. All the connections should be thoroughly checked before providing power supply to the board.

F) Display after motors program execution

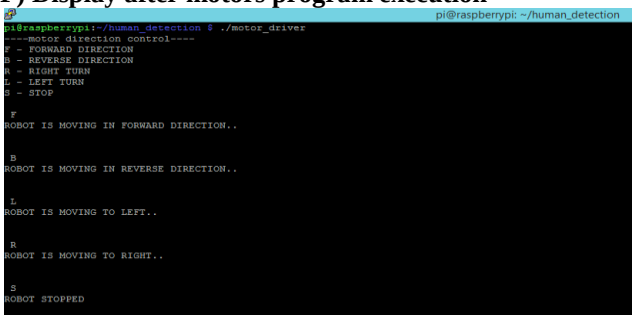


Fig 10: Output on the screen after motor program execution

To execute the motor program the command should be "**./filename**". In my case it is ./motor_driver, then the screen looks as shown in fig 10 above. This program is used to run the robot in any direction for instance to run the robot in forward direction the command should be F or f and output will be displayed as robot is moving in forward direction.

G) Screen after PIR code execution

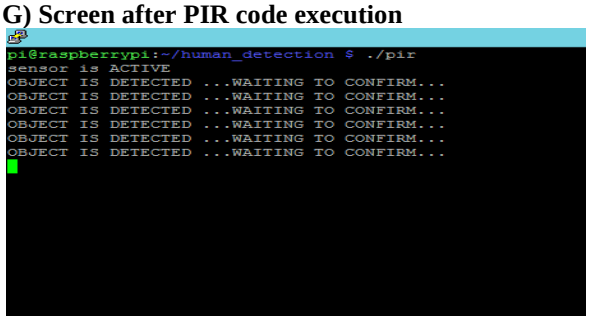


Fig 11: PIR sensor output after object detection

The screen shown in figure 11 is after PIR sensor code execution. As soon as the program is executed the first message will be "Sensor is ACTIVE" and if there is any object detection the display will be shown with a message like OBJECT IS DETECTED…WAITING TO CONFIRM… If there is no object in the way there won't be any message so that he robot can keep going.

H) Ultrasonic sensor output screen

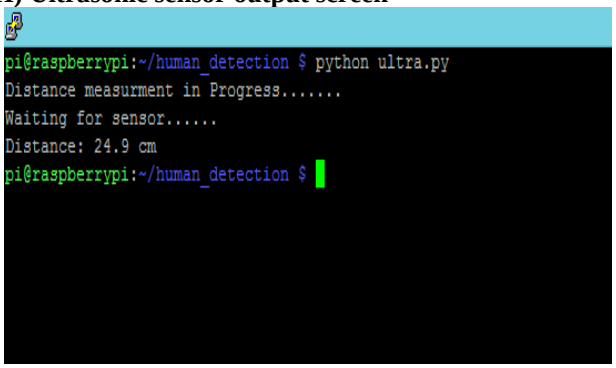


Fig 12: ultra sonic sensor output screen

Once the ultrasonic sensor program is executed using the command **"python ultra.py"** the output on the screen will be as shown in fig 12**.** In order to calculate the distance from the object we need to use ultrasonic sensor.

I) CAM output window

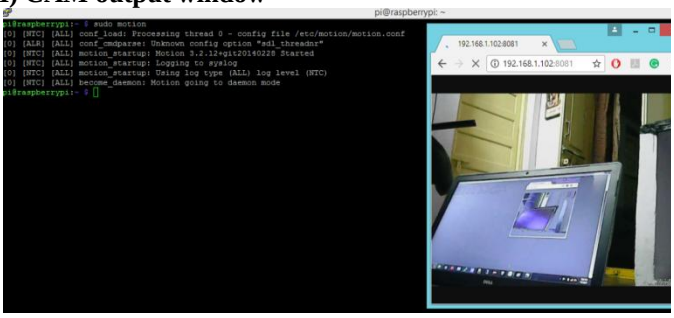


Fig 13: USB cam output screen

To get the live streaming of the location through USB cam the instruction should be **"sudo motion"**. On successful execution we can see live video by entering the IP address in the browser as shown above fig 13.

J) Output screen of overall project operation

Fig 14: Output Screen of overall project operation

After successful operation the final output screen is shown in the fig 5.4. Left side window in fig 14 is used to enter the commands to execute the code and also to operate the robot by giving the right directions. The window on the right side is used to monitoring the location using the USB cam by entering the IP address in any of the browser.

IV. CONCLUSION

The goal of this work was to provide a rescue robot for human detection in a disaster environment. Though, the existing Urban Search and Rescue Robots are equipped with various sensors, but the problem with them is the cost and complexity of circuit. Raspberry Pi3 and PIR sensor plays the major role in this project detect the human presence in disaster zones using a wireless robot which in turn reduce the risk for the rescue teams and to increase the chances of saving more lives on time without any delay in the rescue operation.

V.REFERENCE

[1]Purnima G, Asst. Prof. Aravind S, Renju Mary Varghese, Neethu Anna Mathew, Gayathri C S "Alive Human Body Detection and Tracking System Using an Autonomous Pc Controlled Rescue Robot " International Journal of Emerging Technology and Advanced Engineering Website: www.ijetae.com (ISSN 2250-2459, ISO 9001:2008 Certified Journal, Volume 4, Issue 12, December 2014)

[2]Geetha Bharathi.V.S , Dr.S.Sudha . "Alive Human Detection in Disaster Zones using Manually Controlled Robots "International Journal of Innovative Research in Computer and Communication Engineering *(An ISO 3297: 2007 Certified Organization)* Vol. 3, Special Issue 2, March 2015

[3]https://www.raspberrypi.org/documentation/

[4]https://developer.arm.com/products/processors/cortex-a/cortex-a53

[5]https://en.wikipedia.org/wiki/RaspberryPi

[6]https://learn.adafruit.com/pir-passive-infrared-proximity-motion-sensor/how-pirs-work

[7]http://www.instructables.com/id/Wireless-PIR-Sensor-Alarm/

[8]https://developer.arm.com/products/processors/cortex-a/cortex-a53/docs

[9]https://www.arm.com/products/processors/armv8-architecture.php

[10]https://docs.python.org/3/library/datetime.html

VI.ACKNOWLEDGEMENT

I am greatly thankful to **Dr. V. Usha Shree,** B.Tech, M.Tech, Ph.D, Principal of our college, for extending her valuable help. I shall forever cherish my association with her for her constant encouragement, perennial approachability, absolute freedom of thought and action. I am also greatly thankful to all the faculty members of the department who provided their feedback and valuable suggestions at different stages of the project and helped in the success of the project.

AUTHOR'S PROFILE:

S. Bharath is currently pursuing M.Tech, specialization in Embedded Systems in Joginpally B. R. Engineering College, Moinabad, Hyderabad, Telangana, India, affiliated to JNTU Hyderabad.

Maddu Srinivasa Rao has obtained Master Degree in ECE specialization in Computers and Communications from JNTU Kakinada and BE degree in ECE from Sri Ramanand Theerth Maratwada University , Nanded, Maharashtra. He is pursuing his Ph.D in JNTUH. His research area is in Computer Networks and Communications. He was ratified as Associate Professor by JNTUH. He is presently working as

Associate Professor & HOD in the Department of ECE in Joginpally B.R. Engineering College, Moinabad, Hyderabad and has an experience of 17 years both in Industry & Teaching.

Dr. D.Nagendra Rao. B.Tech, M.E.,Ph.D., MBA. His carrier spans nearly three decades in the field of teaching, administration, R&D., and other diversified in-depth experience in academics and administration. He has actively involved in organizing various conferences and work-shops. He has published over 25 international journal papers out of his research work. He presented more than 15 research papers at various national and International conferences. He is currently approved reviewer of IASTED International journals and conferences from the year 2006. He is presently working a Professor in the Department of ECE in D.R.K Engineering College, Bowrampet, Hyderabad He is also guiding the projects of P.G. /Ph.D. students of various universities.