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Design and Implementation of a Raspberry PI Surveillance Robot with Pan Tilt Raspbian Camera

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Abstract

The paper represents the designing and implementing of a robot that is operated by the credit card sized computer called Raspberry Pi and runs on Raspbian operating system which controls the movement of the robot in all four directions. It uses wireless technology wifi 802.11 for not only controlling the movement of the robot but also uses a pan tilt module for mounting a Raspbian camera that helps to obtain live stream video at that very moment. The three main parts of this robot includes its operation by raspberry pi done using command line of LX terminal, controlling by android operating system done using an app built through appinventor and obtaining live stream video over a particular IP (Internet Protocol) address.

Keywords: Raspberry Pi, Android operating system, Command lines in LX terminal, Appinventor, Raspbian camera .

I. INTRODUCTION

The document presents designing and implementing of a robot for surveillance as well as for covert military missions carried out. The paper helps to design a prototype that would also help to discover unreachable locations like dense forests as well as mines. In this prototype we have developed an android application for mobile devices which run on android OS. This application provides or controls the surveillance robot using wireless technology wifi 802.11. It also provides the live video obtaining from the robot. The robot is based on Raspberry Pi computer which instructs and controls the operations carried on the robot with greater efficiency and higher processing speed. The robot is programmed to be controlled using the android application.

The Android app is basically divided into two modules i.e.

1. Video Streaming Module
2. Robot control Module.

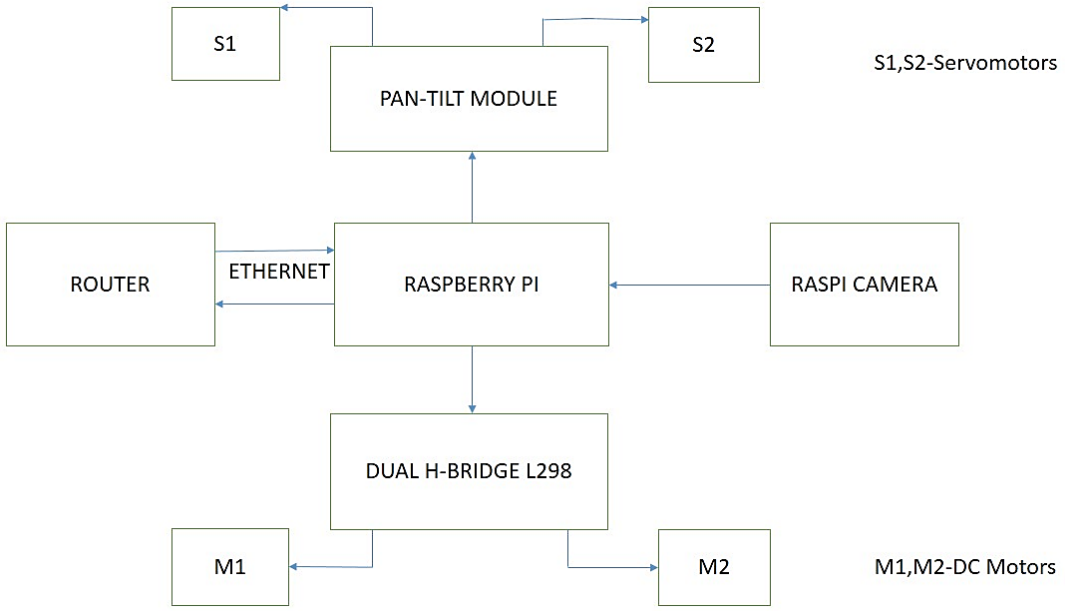
A Raspberry Pi camera is mounted on the robot, through which our android application fetches live stream video and displays it. This video is achieved using WIFI technology. The Uniqueness of this project lies that the video obtained will be in four directions: front, left right and top. This can be achieved using pan tilt module on which the camera will be mounted.

The second module is the control module. Our application provides a GUI to control the robot wirelessly. This control is again achieved using WIFI technology. Buttons are used to control the robot in forward, backward, left or right direction.

Both modules are achieved through wireless technology for which a router will be used connected to raspberry pi computer. A two-way communication will be established between a router and the android application since all the controlling instructions are transmitted through one way and video streaming will be received through another way. By using a router, the range of our prototype will surely be increased by 100-150 m. All this will be done by assigning a particular IP and a port number to each component actively participating in live stream video reception.

All the components like pan tilt system module, raspberry pi camera, router module, H-Bridge IC are interfaced to the raspberry pi computer. Two DC motors are interfaced to the H-Bridge IC for its movement in forward, backward, left and right direction. Two servomotors are also interfaced to raspberry-pi on PWM (Pulse Width Modulation) pins that are used for pan tilt module to obtain movement in horizontal as well as vertical direction.

II. BLOCK DIAGRAM AND WORKING:



The development starts with loading of Operating System for Raspberry Pi called Raspbian Jessie onto a SD card. After that booting is done with the help of HDMI cable to connect the computer to a Screen, also connect Keyboard and mouse through USB ports. Perform the instructions for completing the booting process. Load the raspberry cam module instructions and check its validation by connecting to the camera at once. Now using LX terminal, write the line commands required for the operations to be performed by the computer since all components like pan tilt module, camera module, router module and H-Bridge IC are interfaced to it. LX terminal commands needs to be carefully typed since you need to give permissions to the files which are being downloaded, created and written to the root directory.

On the next level an android app is built using Appinventor online platform which controls the movement of robot in all four directions and even tilting of camera in different directions. All the functions of apps are provided by the building platform and its link to the robot are done via router over a WIFI technology 802.11. The app is downloaded onto an android mobile by scanning the QR code, for perfect controlling by the user at different places.

After the software part is taken care of, hardware part is handled by first assembling the DC motors to the chassis using nuts and bolts. Even the servo motors are aligned with pan-tilt module such that full rotational movement is obtained. The DC motors are connected to the H-bridge IC L298 using wires for proper current amplification necessary to drive the motors whereas the servomotors are connected to the PWM pins on the Raspberry Pi for rotational movement.

A Router with single antenna is used and is interfaced with the Raspberry pi with the help of an Ethernet cable. It not only helps to increase the range of our robot in terms of distance across line of sight but also to obtain better quality video stream by decreasing the number of frames/second transmitted over the network. The components including a sealed lead acid battery (12 V) to provide power supply to all the components is assembled and organized onto the chassis. As the construction of the robot is complete with all the software as well as hardware part, now the testing phase of robot starts.

First assign an IP by creating a hotspot to the main networking components like raspberry pi computer, android app and the router. Use the buttons on the android app in order to move the robot in different directions as well as to rotate the camera in horizontal and vertical directions in order to obtain live stream video. The video is obtained on the screen of the android app. The rotational speed of the DC motors is about 60 rpm. This very robot will provide movement in all four directions and obtain live stream video in vertical and horizontal directions.

III.PROGRAMMING OF SERVER, COMPONENTS AND ANDROID APP:

The software part development took in two phases:

(a) Programming of video server for Raspberry Pi camera

The programming was done using command lines in LX terminal of the raspbian operating system. It involved writing the commands for downloading the server from the internet as well as making it executable and auto start during booting in order to obtain the live stream video through the raspberry camera.

(b) Programming of components interfaced with Raspberry Pi

The programming of General purpose pins on Raspberry Pi which connects components like H-Bridge IC, Pan-Tilt Module and the motors was done using command lines in LX terminal. Each instruction, loop, time delays are programmed for proper controlling of the robot.

(c) Programming of android app for android devices

The app was built on the platform known as Appinventor. All the functions were provided by the platform. After the app was built with all necessary instructions it was downloaded onto the android devices with the help of QR code scanner.

IV. CONCLUSION

The paper has described a robot whose operation is totally based on Raspberry Pi, a small pocket size computer that has really helped in contributing to basic computer studies .Its controlling is done with the help of an android app and live video stream is obtained with the help of raspberry pi camera mounted on a pan-tilt module. All the controlling and streaming is done over a wireless technology wifi 802.11 by using a particular internet protocol. This IP connects all the networking components of the robot and helps us in smooth operation of raspberry pi based robot.

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REFERENCES

[1] **Phey Sia Kwek, Zhan Wei Siew, Chen How Wong, Bih Lii Chua and Kenneth Tze Kin Teo** "DEVELOPMENT OF A WIRELESS DEVICE CONTROL BASED MOBILE ROBOT NAVIGATION SYSTEM" 2012 IEEE Global High Tech Congress on Electronics.

[2] **Pavan.C, Dr. B. Sivakumar** "Wi-Fi ROBOT FOR VIDEO MONITORING & SURVEILLANCE SYSTEM" International Journal of Scientific & Engineering Research Volume 3, Issue 8, August-2012.

[3] **A.Sivasoundari, S.Kalaimani, M.Balamurugan** "WIRELESS SURVEILLANCE ROBOT WITH MOTION DETECTION AND LIVE VIDEO TRANSMISSION" International Journal of Emerging Science and Engineering (IJESE) ISSN: 2319–6378, Volume-I, Issue-6 April 2013.

[4] **Saliyah Kahar, Riza Sulaiman, Anton Satria Prabuwono,_Mohd Fahmi Mohamad Amran, Suziyanti Marjudi** "Data Transferring Technique for Mobile Robot Controller via Mobile Technology" 2011 International Conference on Pattern Analysis and Intelligent Robotics 28-29 June 2011.

[5] **Xichun Li, Abudulla Gani, Rosli Salleh, Omar Zakaria**. 2009. The Future of Mobile Wireless Communication Networks. 2009 International Conference on Communication Software and Networks.

[6] **Michael Ransburg, Mario Jonke, and Hermann Hellwagner**; An Evaluation of Mobile End Devices in Multimedia Streaming Scenarios.<http://wwwitec.unilu.ac.at/publications/mmc/paper9355.pdf>