



OPERATIONS AND INSPECTION FOR SHADOWY SURFACE USING AUTONOMOUS ROVER

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Abstract-Autonomous Rover is used to detect and identify the objects in the dark region. The main objective of this paper is to design and implement wireless rover which will enable us to control the rover with the help of WIFI and it will be able to detect the objects. The object images are live streamed and captured by the rover and the user can access the image transmitted from the remote area such as dark areas which are beyond our reach, which helps in rescue operation. This paper introduces the strategy of RASPBERRY PI connecting to a desktop wirelessly.

Keywords: Rover, Raspberry-Pi, Wi-Fi, Live streaming, Servo motor.

I. Introduction

Robots are used in variety of industrial applications such as pick and place, painting, assembling of subsystems and in hazardous places for material handling etc. Robots are becoming more and more intelligent as technology advances in the areas of CPU speed, sensors, memories etc. And there is ever demanding applications even in defense. With the rapid growth of the Internet, more and more intelligent devices or systems have been embedded into it for service, security and entertainment, including distributed computer systems, surveillance cameras, telescopes, manipulators and mobile robots. Although the notion of Internet robotics or web-based robotics is relatively new and still in its infancy, it has captured the huge interest of many researchers worldwide. Except for operating in hazardous environments that are traditional tele-robotic areas, Internet robotics has opened up a completely new range of real-world applications, namely tele-manufacturing, tele-training, tele-surgery, museum guide, traffic control, space exploration, disaster rescue, house cleaning, and health care. Automated video surveillance is an important research area in the commercial sector as well. Technology has reached a stage where mounting cameras to capture video imagery is cheap, but finding available human resources to sit and watch that imagery is expensive. Surveillance cameras are already prevalent in commercial establishments, with camera output being recorded to tapes that are either rewritten periodically or stored in video archives.

In the proposed Robotic System, the Rover is sent to the dark areas which are beyond our reach. This system helps the rover to run on an irregular terrain. There it detects and identifies the objects in the dark surface and transmits to the user by performing Live Streaming with the help of MJPG Streamer through Wi-Fi. Image of the last seen video is captured and saved by the Streamer when the Streamer is off and we can view the same image by opening the Streamer again. The autonomous rover has faced the following issues: This model fails to make a good communication between the user and the robot which means, it fails to prove that it is an autonomous robot. Due to the earlier version of hardware interfacing in embedded systems the video streaming capability of the robot got minimized. There is a need for Microcontroller and RF connection for operation. Lagging in signal acquisition and signal acquisition based on multi sensor integration. The requirements for real-time autonomous control signal processing, data logging, and communications with an external computer. Size of the robot increased due to integration of large number of sensors. Total power supply of the robot increased and limiting the distance traverse of the robot.

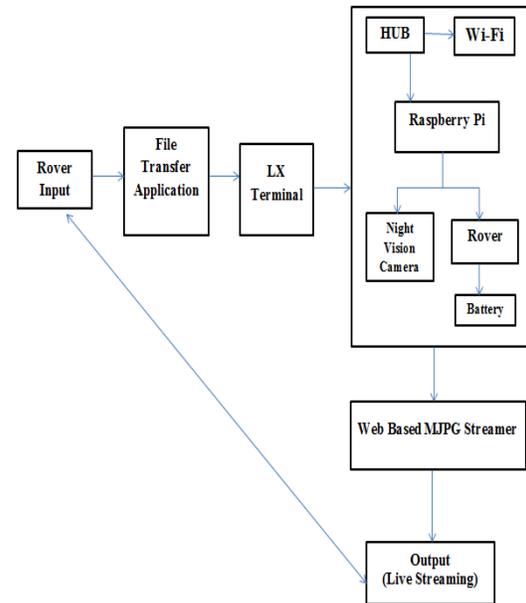
II. Related Work

In this paper, Wi-fi is used for controlling the robot and GPS tracking system is used for tracking the robot. Wi-fi concept is used for controlling the rover. The robot is designed in such a way that it works wirelessly and controlled using Wi-fi. Using GPS tracking system, robot can be traced +/-50m approximately during the clear sky. [1]

Traction Mechanism of Locker Crawler System. Crawler Mechanism is good for driving on irregular terrain because of its low contact force with the outside area. Thus the paper describes the work on technical issues related to surface exploration in future by rovers in the south polar region of the moon using the above mentioned methods. [3]

III. System Design

The figure shows the proposed system with the overall Architecture where the RASPBERRY PI plays a vital role. The architecture consists of rover input, File transfer application (Putty software), LX Terminal, hub, Wi-Fi, night vision camera, battery and the monitor respectively. For enabling the rover and the camera, input is given through the system. Rover is a locomotive device used in lunar surfaces. Hub is used in a wired network to connect Ethernet cables from a number of devices together. The hub allows each device to talk to the others. Wi-Fi is used for communication. Raspberry Pi is a small SD card sized peripheral device which connects the night vision camera and the rover. Night vision camera is used for live streaming. Battery gives the power supply for the rover motion. MJPG streamer is a command, used for enabling the camera. Final output is transmitted to the system (output).



IV. Hardware and Mechanical Design of Rover

Servo Motor:

Motors are used to drive the mechanical part of the robot. For this application some special types of motors are required with some special arrangement which makes the motor to rotate a certain angle for a given electrical input. The type of motor used here is a Servo Motor, which is a DC motor.

The major advantage of DC motor is that, the speed variation is possible and easy when compared to AC.

The main reason behind using a servo is that it provides angular precision, i.e. it will only rotate as much we want and then stop and wait for next signal to take further action.

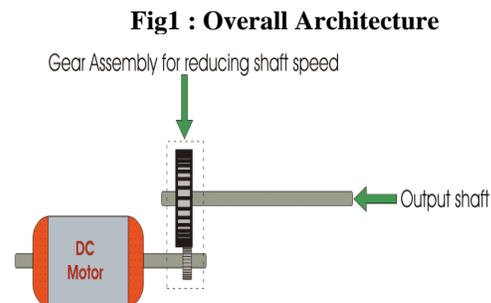


Fig2: Servo Motor

We use gear arrangement to increase the torque of the motor. Base Lift design mechanism is used to lift the upper body from base. It is used to separate the base section and upper section. Tyre is made up MRF hard rubber. Wheels and Castors are mechanical devices that convert rotary motion to linear motion (or vice versa). It is actually a round mechanical part rotating around an axis. The wheel is the basis of all mobility system.

V. Raspberry Pi

A Raspberry Pi is a credit card sized computer board. It is also called as SOC (System On Chip). It is when plugged into an LCD and attachment of a

keyboard and mouse, it is able to complete the functions of any regular PC can. Like a PC, it has RAM, Hard Drive (SD Card), Audio and Video ports, USB port, HDMI port, and Ethernet port. With the Pi, users can create spread sheets, word-processing, browse the internet, play high definition video and much more. It was designed to be a cost friendly computer for users who needed one. There are two models, Model A and B. Model B is the faster containing 512MB of RAM as well as the ability to over clock

Raspberry Pi's hard drive is the SD card inserted into it. The minimum requirement for the SD card is 4 GB and it can go up to 32 GB. Pi is also Linux based and the OS is stored. The default programming language provided by Raspberry Pi is Python. Other languages such as Java, C and C++ can also be installed and used if the programs are installed on the system.

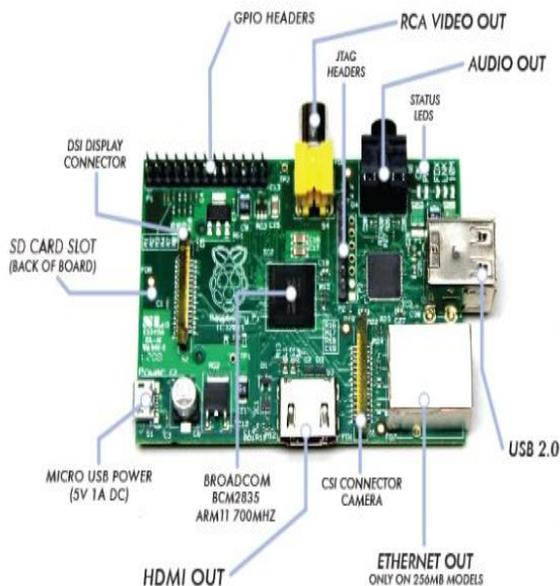


Fig3: Schematic Diagram of Raspberry Pi

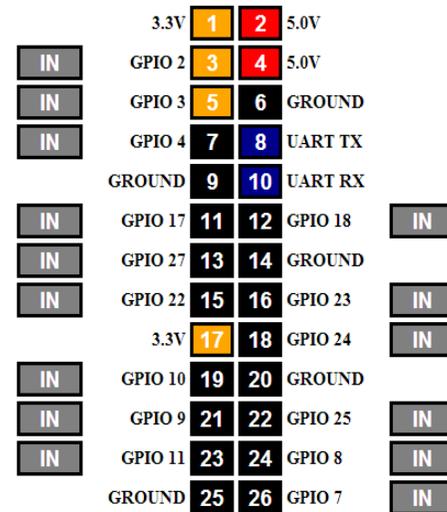


Fig4: Raspberry Pi PIN Configuration

VI. Implementation and Experimental Results

The experiment is carried out in Linux Platform, which provides stronger security than that of Windows. Putty is an SSH and telnet client, is an open source software that is available with source code and is developed and supported by a group of volunteers. Secure Shell (SSH) Protocol is a protocol for secure network communications designed to be relatively simple and inexpensive to implement.

Server authentication occurs at the transport layer, based on the server possessing a public-private key pair. A server may have multiple host keys using multiple different asymmetric encryption algorithms. Multiple hosts may share the same host key. In any case, the server host key is used during key exchange to authenticate the identity of the host.

The SSH Connection Protocol runs on top of the SSH Transport Layer Protocol and assumes that a secure authentication connection is in use. To secure this connection, SSH is configured so that the SSH Transport Layer Protocol establishes a TCP connection between the SSH client and server entities with TCP port numbers. After this we can connect the Pi running from any operating system using SSH. Wi-Fi is used for system communication which operates as a wireless Ethernet.

A camera is an optical instrument that records images that can be stored directly, transmitted to another location, or both. These images may still photographs or moving images such



as videos or movies. Here, Raspberry Pi USB Webcam is used, which is a night vision camera. MJPG Streaming server is used for the motion of Raspberry Pi camera. So MJPEG Streamer is installed and set up using the raspistill utility, that is a part of Raspbian. Now the Streamer is started and go to any device that has a web browser and connect to the website using a particular IP Address.

Advantages: Very strong security is provided by the Linux OS. Wi-Fi, which is used for long distance communication. The size of the rover is small as there is only one sensor is used. Raspberry Pi helps to connect single mouse and keyboard. The crawler mechanism helps the rover to run on any irregular terrain.

VII. Conclusion

Using this proposed technology, it helps us in detecting and identifying the objects in the dark regions. This robotic system can also be used in high altitude areas where it is difficult for humans to survive as some of our border areas fall into high altitude areas. The proposed robotic system can also be used in finding the injured persons during the disasters such as earthquakes, collapsing of building and also in the mining fields and it can be used as a spy robot.

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