

2.2 Applications of Embedded Systems

Consumer applications:

At home we use a number of embedded systems which include microwave oven, remote control, vcd players, dvd players, camera etc..

Office Automation :

We use systems like fax machine, modem, printer etc...

Industrial automation:

Today a lot of industries are using embedded systems for process control. In industries we design the embedded systems to perform a specific operation like monitoring temperature, pressure, humidity, voltage, current etc., and basing on these monitored levels we do control other devices, we can send information to a centralized monitoring station.

In critical industries where human presence is avoided there we can use robots which are programmed to do a specific operation.



Fig 2.1: Robot

Tele communications:

Cell phones, web cameras etc.

Security:

Embedded systems are used in security systems such as burglar alarms and fire alarms.

Aerospace:

Embedded systems are used in aircraft and spacecraft.

3.3 Hardware Description

3.3.1 About Raspberry pi

The **Raspberry Pi** is a credit-card-sized single-board computer developed in the UK by the Raspberry Pi Foundation with the intention of promoting the teaching of basic computer science in schools. The Raspberry Pi is manufactured through licensed manufacturing deals with Newark element14 (Premier Farnell), RS Components and Egoman.

The Raspberry Pi 3 Model A+ is the latest product in the Raspberry Pi 3 range. Like the Raspberry Pi 3 Model B+, it boasts a 64-bit quad core processor running at 1.4 GHz, dual-band 2.4 GHz and 5 GHz wireless LAN, and Bluetooth 4.2/BLE.

Pin Description

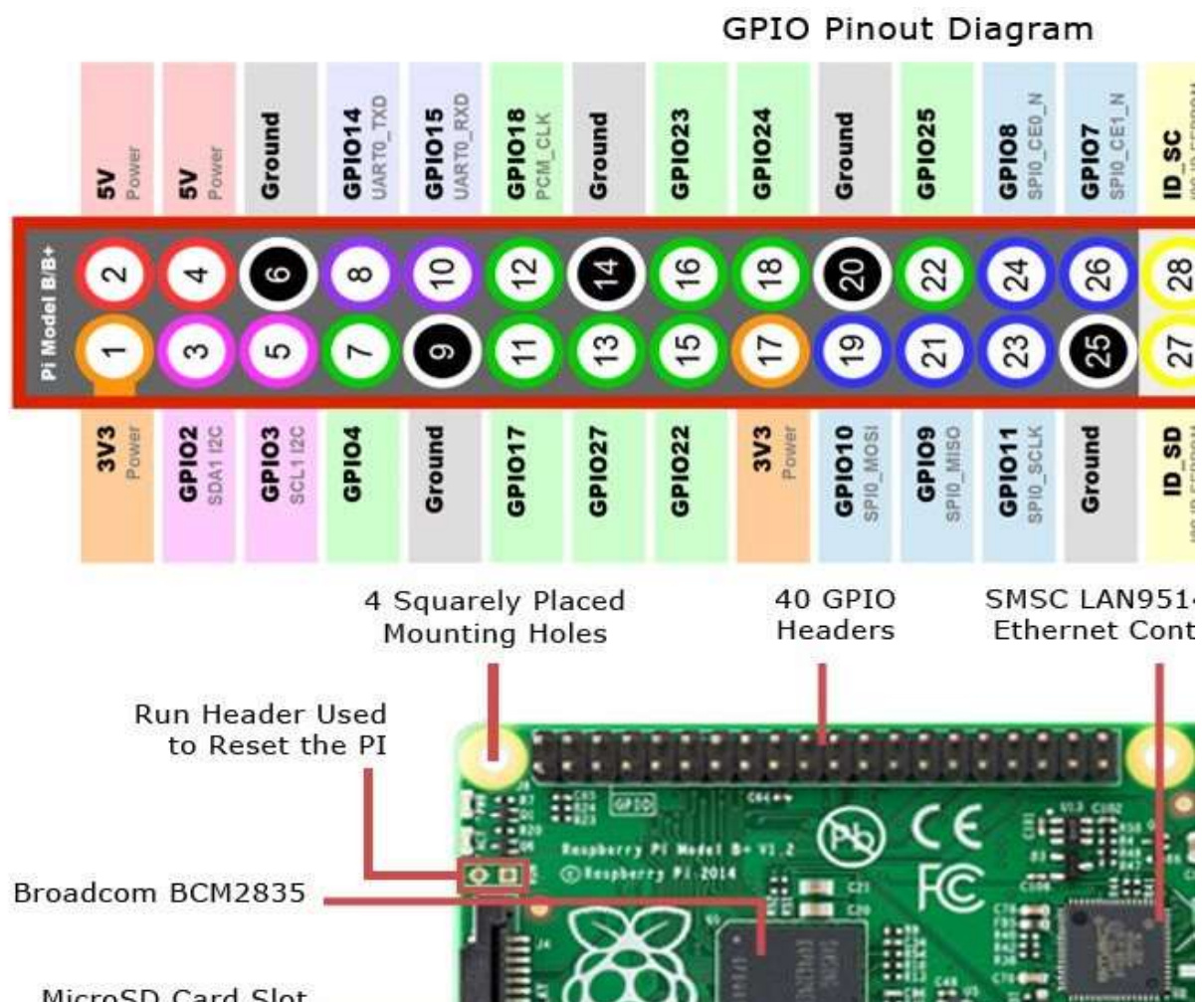


Fig 3.1: Raspberry Pi pin description

3.3.2 Camera Module

The camera consists of a small (25mm by 20mm by 9mm) circuit board, which connects to the Raspberry Pi's Camera Serial Interface (CSI) bus connector via a flexible ribbon cable. The camera's image sensor has a native resolution of five megapixels and has a fixed focus lens. The software for the camera supports full resolution still images up to 2592x1944 and video resolutions of 1080p30, 720p60 and 640x480p60/90. The camera module is shown below:

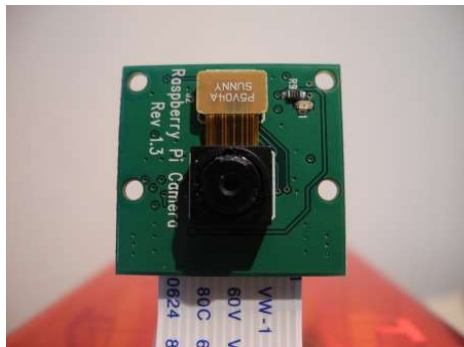


Fig 3.2: Raspberry Pi Camera

3.3.3 Bluetooth module HC – 05

The Bluetooth module HC-05 is a MASTER/SLAVE module. By default the factory setting is SLAVE. The Role of the module (Master or Slave) can be configured only by AT COMMANDS. The slave modules cannot initiate a connection to another Bluetooth device, but can accept connections. Master module can initiate a connection to other devices. The user can use it simply for a serial port replacement to establish connection between MCU and GPS, PC to your embedded project, etc. Just go through the datasheet for more details.

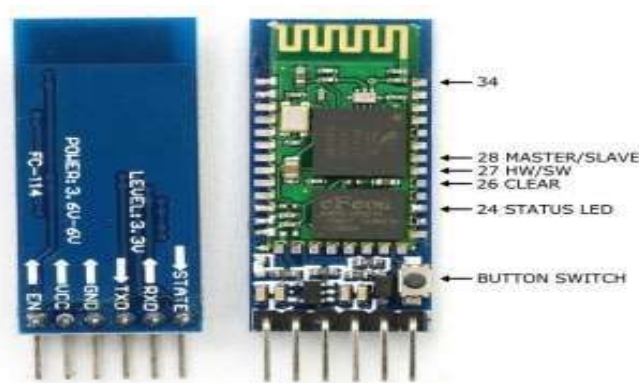


Fig 3.3: HC – 05 Bluetooth

Implement the necessary controls (e.g., buttons, joystick) in the user interface to send commands to the Raspberry Pi for controlling the robot's movement

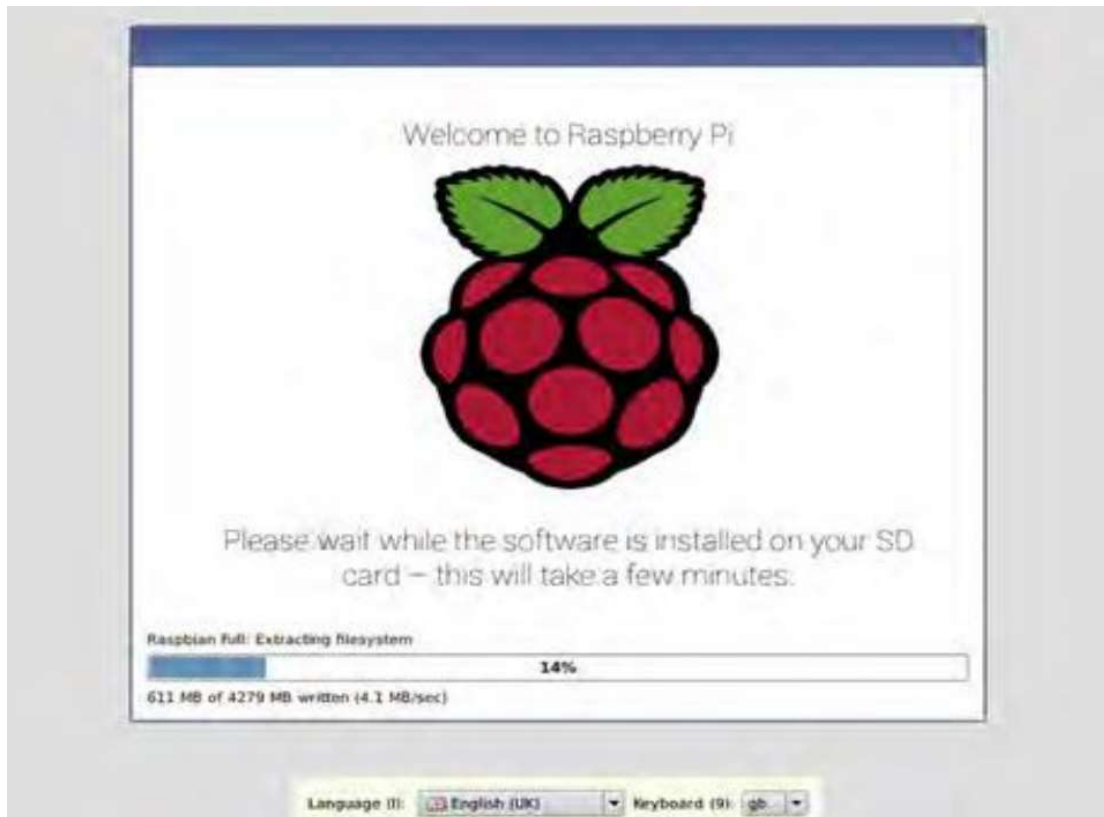


Fig 6.1: Installation of Raspberry pi Os

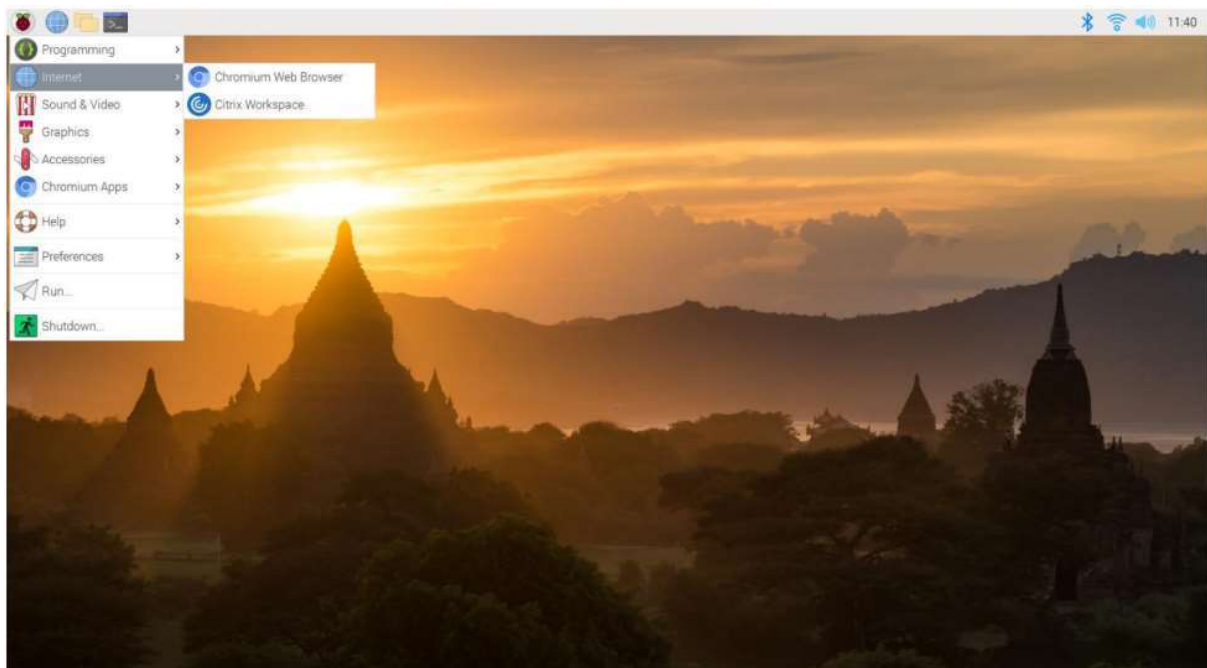


Fig 6.2: Raspbian Desktop

Chapter 8

Results

After assembling the hardware and installing and running the software we successfully demonstrated that the telepresence robot provides us the video streaming in the direction of our requirement.

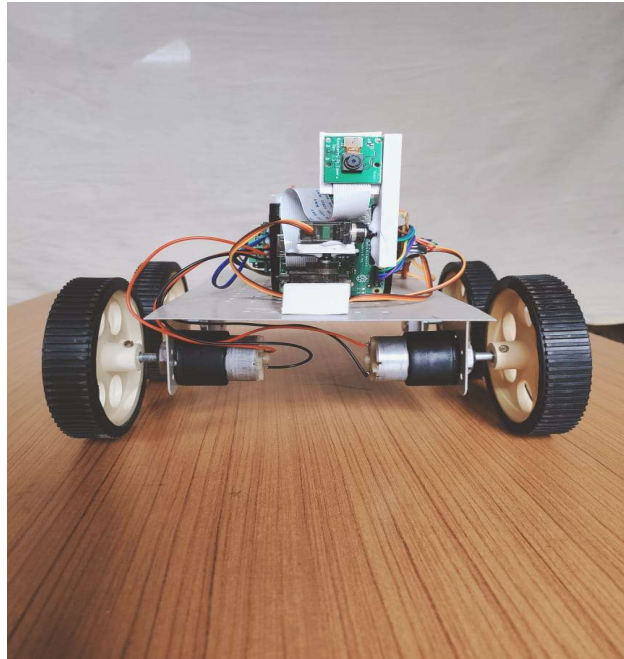


Fig 8.1: front view of robot

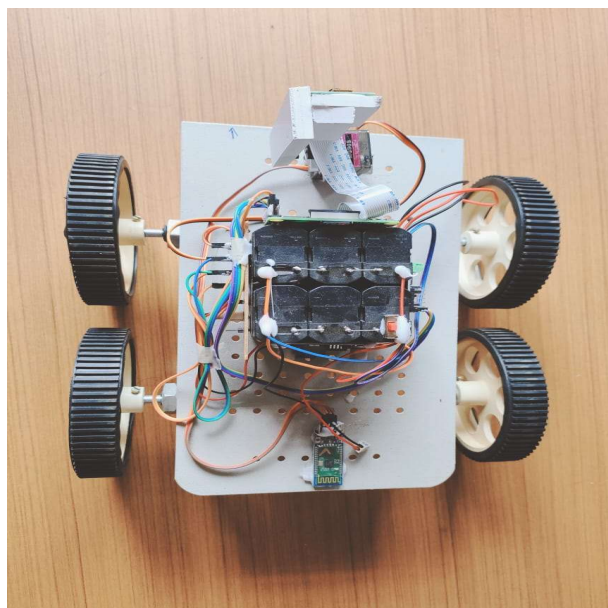


Fig 8.2: Top view of robot

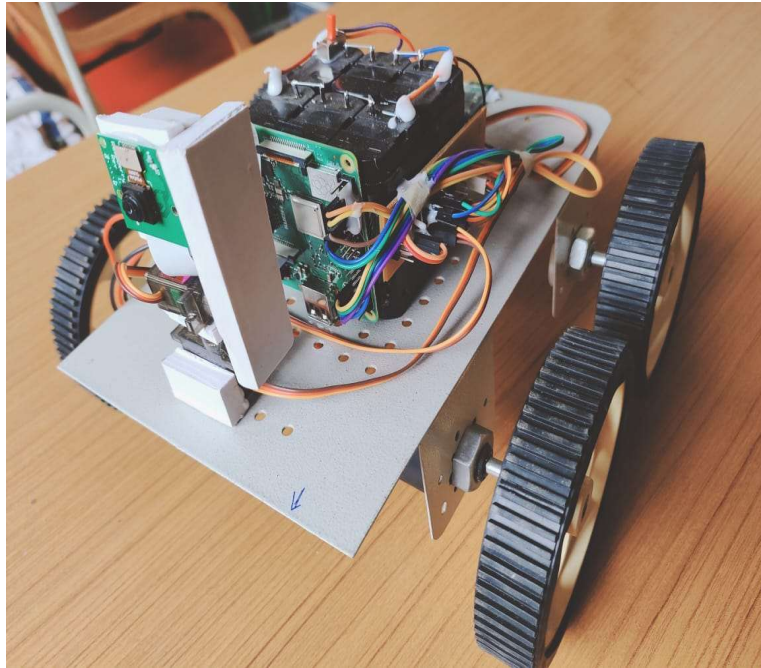


Fig 8.3: View of camera and raspberry pi modules



Fig 8.4: Picture captured during the movement of robot

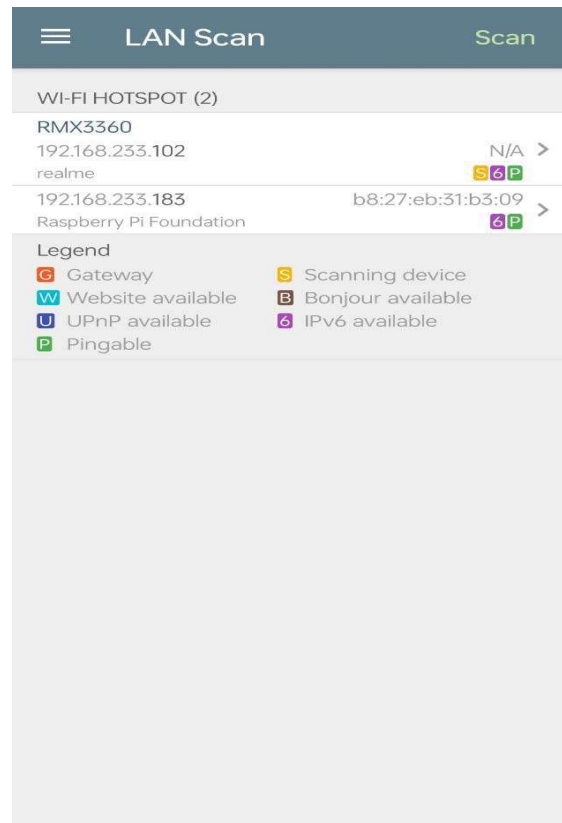


Fig 8.7: Network analyzer application

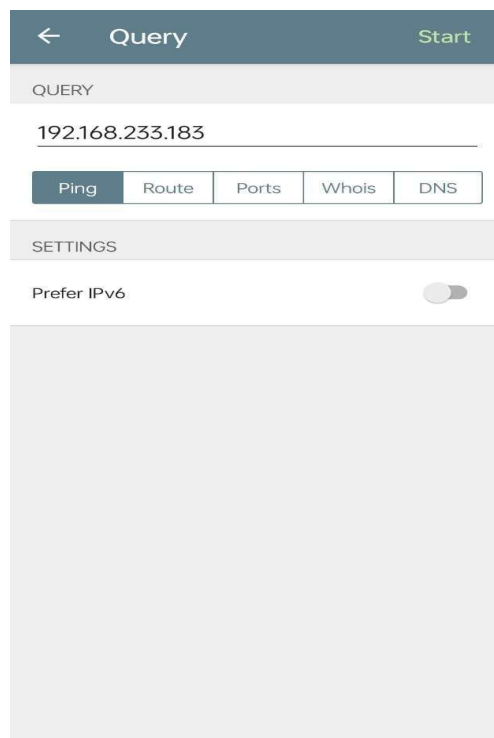


Fig 8.8: View of IP address in network analyzer



Fig 8.9: Wireless IMU application

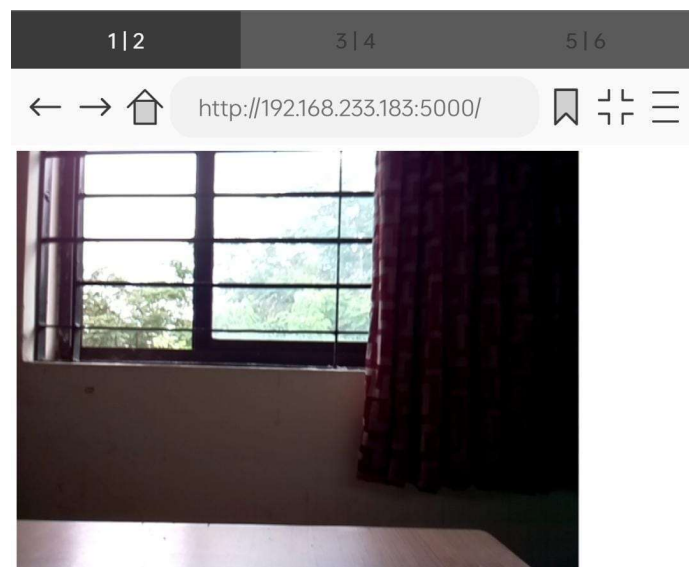


Fig 8.10: Visuals of camera in dual browser application

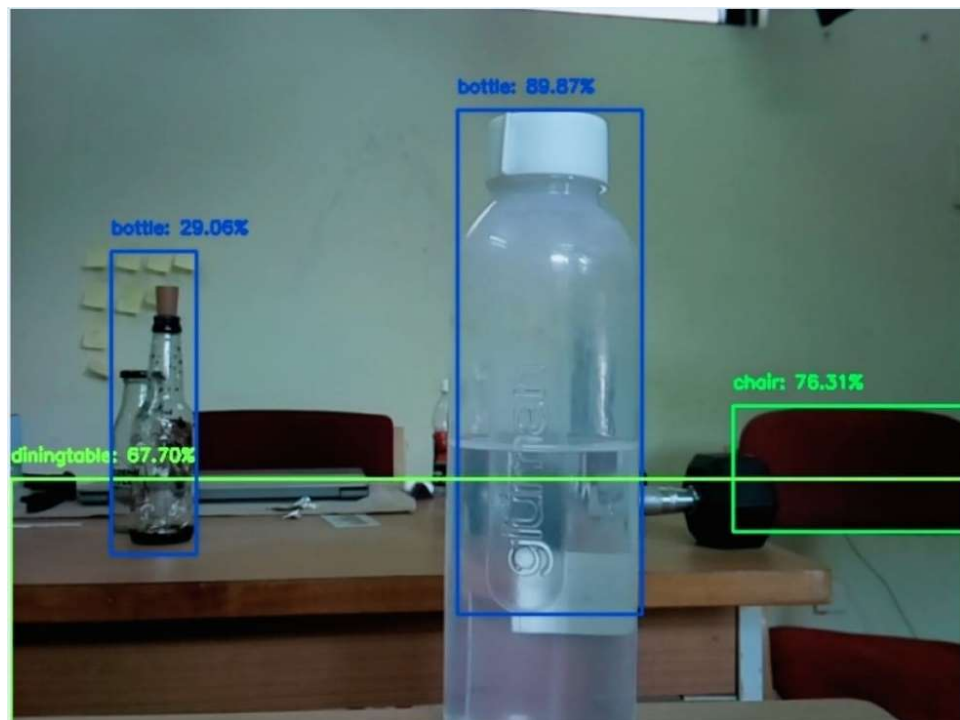


Fig 8.11: Object detection view