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Fi-Pi Raspberry-Pi Adaptor Board for Firebird-V

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Abstract

The project aims at developing Raspberry-pi based Adaptor board for Firebird series Robots.As Raspberry- Pi can cater to more applications specifically in domain of image processing and IOT and provides a new feature of onboard computing which was not present in earlier versions Firebird series. Main features included in this Raspberry- pi based firebird are :-

- Differnet communication choices i.e through XBEE,Bluetooth,USB,DB9, or any serial communication protocol of your choice can used for communication purposes.
- Interfacing Camera on board and live image capturing and video streaming enhances its capabilities and horizon of its applications in different domains.

Completion status

The work flow of the project designed and its completion status is as follows:-

Task	Completion Status	Remarks
Understanding Firebird and Raspberry-Pi	Completed	Firebird and Raspberry -pi were studied and pins of firebird mapped properly and BAsic operations of Raspberry -Pi werev studied
Interfacing ADC and port Expander	Completed	ADC MCP3008 and Port Expander MCP23017 were interfaced with raspberry-pi and firebird by enabling spi and i2c communication and installing packages serial and smbus
Powering circuit for pi	Completed	A circuit for powering Raspberry-pi using LM7805BT with 3A current capacity was designed
Communication protocols	Completed	Communication protocols like XBEE,DB9,USB were tested by sending commands to firebird through pi
LCD and Motion control	Completed	LCD in 4 bit mode was interfaced using pi and motors were operated at different speeds
Camera interfacing	Completed	Camera was interfaced with pi and images, videos were saved on pi.
Adaptor Board PCB	Completed and revised to new version	PCB was designed and tested with firebird.A newer version was designed with some changes
Manual	Completed	Both Hardware and Software manuals were designed incuding all the features ob board with their codes .

1.1 Hardware parts

- List of hardware

1. Raspberry Pi
   Download Datasheet , Vendor Details

Figure 1.1: Raspberry Pi

2. FireBird V Robot
   Download Datasheet , Vendor Details

Figure 1.2: FireBird V Robot

3. MCP23017 IC
   Download Datasheet , Vendor Details

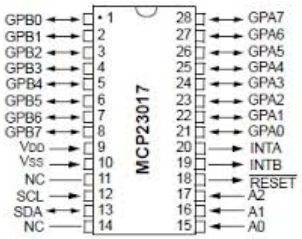

Figure 1.3: MCP23017 IC

4. MCP3008 IC
   Download Datasheet , Vendor Details

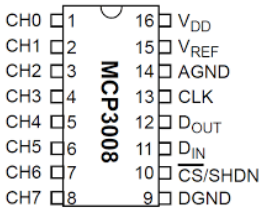

Figure 1.4: MCP3008 IC

5. FT232 IC
   Download Datasheet , Vendor Details

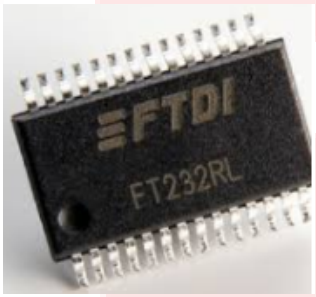

Figure 1.5: FT232 IC

6. MAX202 IC
   Download Datasheet , Vendor Details

Figure 1.6: MAX202 IC

7. LM324 IC
   Download Datasheet , Vendor Details

Figure 1.7: LM324 IC

8. LM7805 IC
   Download Datasheet , Vendor Details

Figure 1.8: LM7805 IC

9. LM1117 IC
   Download Datasheet , Vendor Details Vendor Details

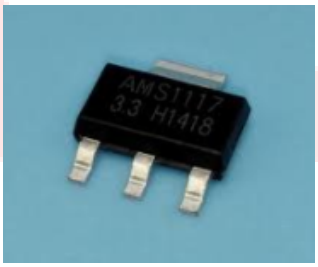

Figure 1.9: LM1117 IC

10. LED
11. Resistor
12. Bargraph LED
13. Switches
14. Header pins

1.2 Software used

- MobaXterm Download Link
  Personal Edition 9.4
- Raspbian Jessie Download Link
  Disk Image Version 2
- Autodesk Eagle Download Link
  Version 8.2.1
- XCTU Download Link
- Win32 Disk Imager Download Link
- SD card Formatter Download Link
- DHCP server Download Link
  Version 2.5.2
- Serial Terminal Download Link

1.3 Assembly of hardware

Circuit Diagram

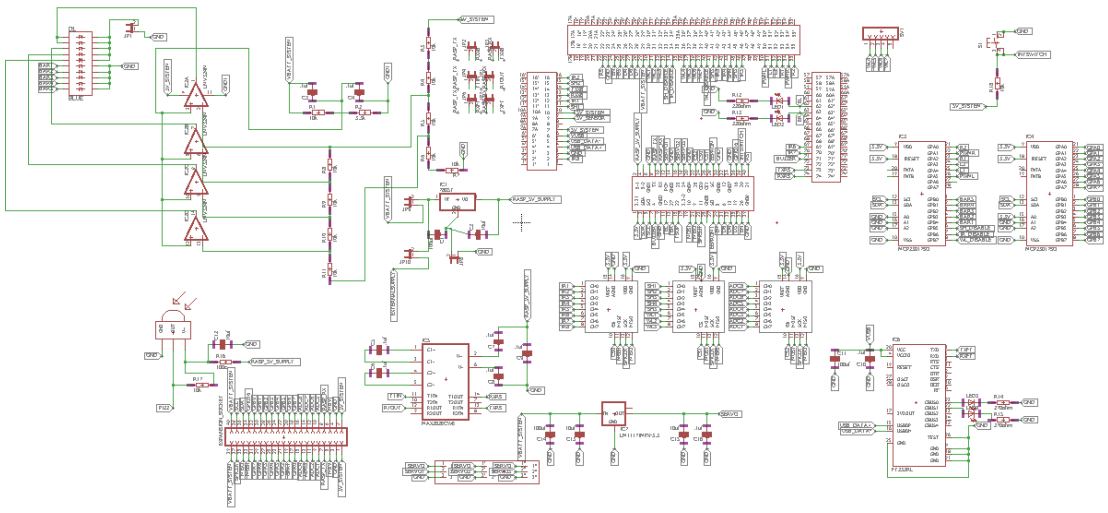

Figure 1.10: schematic

For more details refer to github link Fi-Pi schematics

Eagle Layout

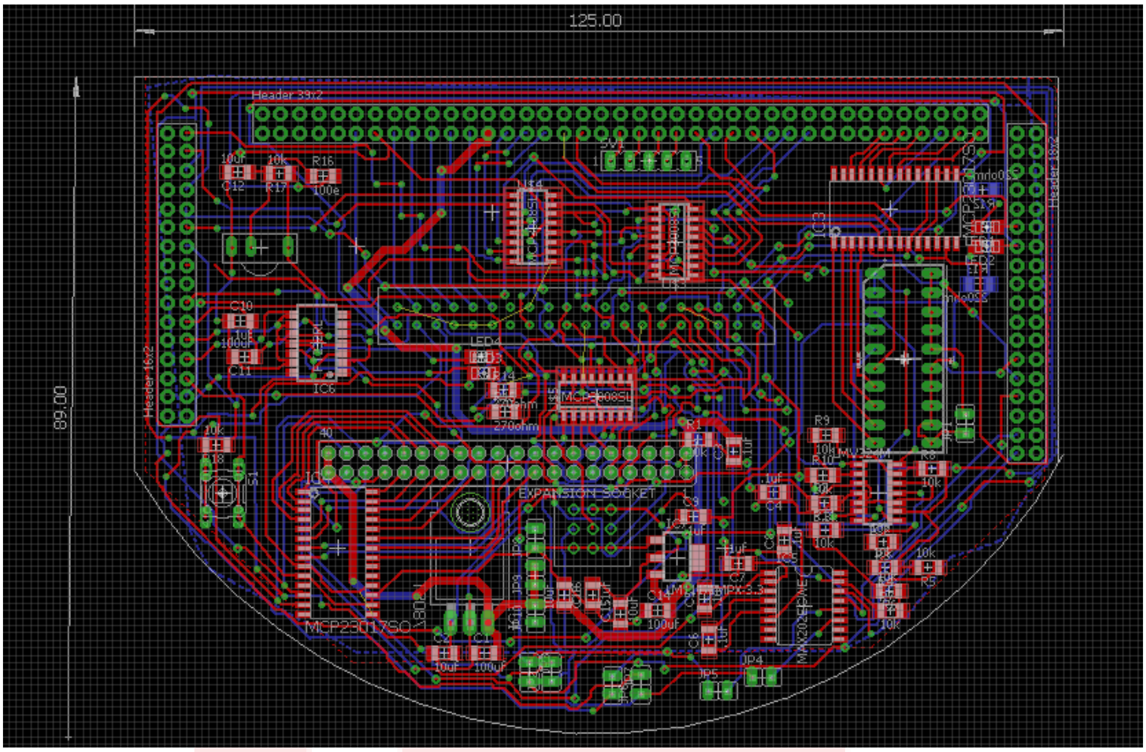

Figure 1.11: PCB board layout

For more details refer to github link Fi-Pi layout

Steps for Assembling the parts

Step 1

Get the PCB etched with the gerber file created from the eagle board layout.

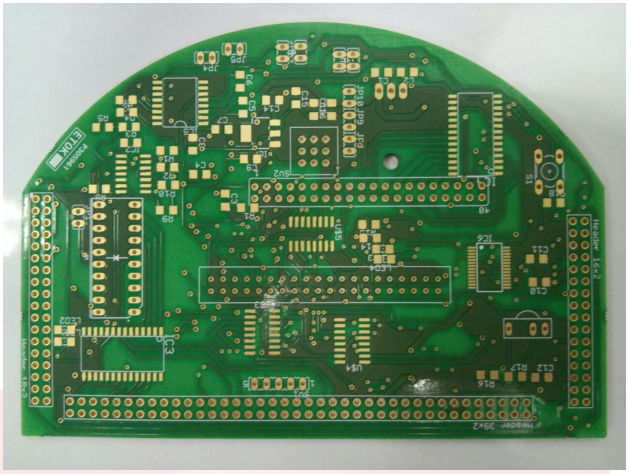

Figure 1.12: PCB board layout

Step 2

Place the SMD and Through hole components appropriately in proper orientation and location. Finally solder them

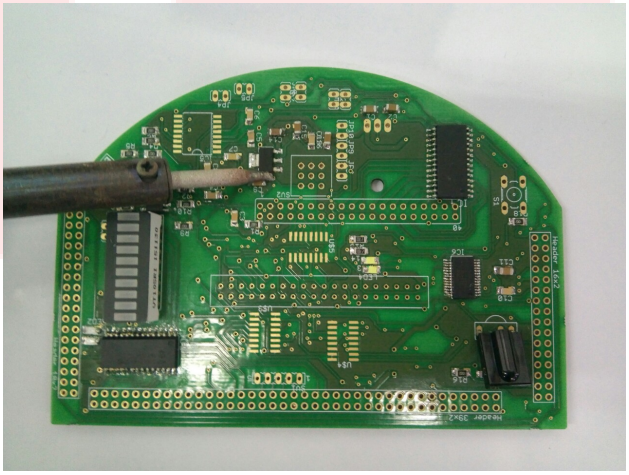

Figure 1.13: PCB board layout

Step 3

The final PCB looks as shown below.

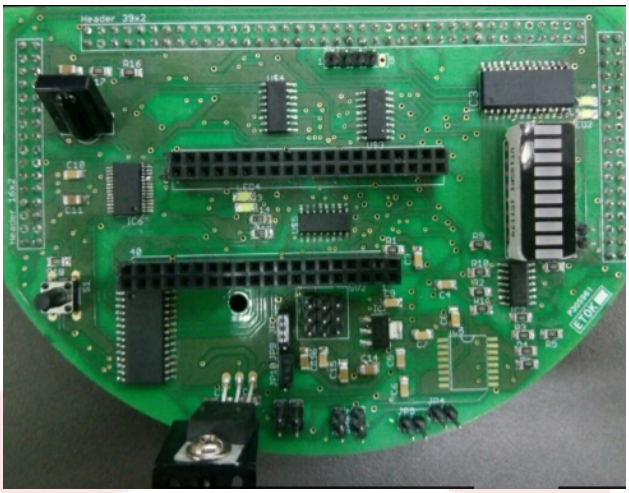

Figure 1.14: PCB board layout

1.4 Software and Code

Github link for the repository of code

1.5 Future Work

Raspberry-pi is a good option for IOT applications so a website can be designed which could be linked to the Raspberry-pi enabled Firebird and data from firebird can be regularly sent let be the sensor values and displayed on the site and stored for further applications.
It may help in tracking conditions of environment from internet and making plant watering bot by detecting plants in the garden through image processing and water them by detecting the humidity and hence watering accordingly.

1.6 Bug report and Challenges

Some changes in Hardware (PCB) have been made and a newer version of PCB is designed:-

- External powering port with external separate battery
- Raspberrypi pin header modified for plug and play directly
- Transistors are interfaced instead of jumpers for changing the communication platform from one to another and hence can be controlled through software means.
- Motors moved to Pi pin header and LCD to port expander beacuse LCD is somewhat useless as we can do ssh and check it on laptop and hence saving power.

Bibliography

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