







A.1 Code Generation Using Xilinx ISE 14.6 1. Starting the ISE Design Suite

Follow these steps to launch Project Navigator software and create an ISE project.

To start the ISE Design Suite, double-click the Project Navigator icon (Figure A.1) on desktop as shown in Figure , or select Start > All Programs > Xilinx ISE Design Suite > Xilinx Design Suite > ISE Design Tools > Project Navigator.



Figure A.1: Project Navigator Desktop Icon

 Click the New Project button to launch the New Project Wizard or from Project Navigator, select File > New Project. The New Project Wizard appears as shown in Figure A.2.

Create New Pro	ject	
Specify project locatio	n and type.	
Enter a name, locat	ions, and comment for the project	
Name:	anncon2101	
Location:	shtha \simulation programs \Sonal_Final kit progrmme \annconfiguration2101 \anncon2101	
Working Directory:	shtha \simulation programs \Sonal_Final kit programe \annconfiguration 2101 \anncon 2101	
	ap-level source for the project	
Top-level source ty	pe:	

Figure A.2: New Project Wizard—Create New Project Page

- 3. Verify that HDL is selected as the Top-Level Source Type, and click Next. The New Project Wizard—Device Properties page appears as shown in Figure A.3.
- 4. In the window, select the device and project properties and change the settings according to FPGA board shown in Figure A.3.

Appendix A

5. Click Next and then Finish, to complete the project creation.

roject Settings		
pecify device and project properties.		
elect the device and design flow for the pr	oject	
Property Name	Value	
Evaluation Development Board	None Specified	-
Product Category	All	-
Family	Spartan6	• •
Device	XC6SLX45	-
Package	CSG324	-
Speed	-2	•
Top-Level Source Type	HDL	
Synthesis Tool	XST (VHDL/Verilog)	-
Simulator	ISim (VHDL/Verilog)	
Preferred Language	VHDL	
Property Specification in Project File	Store all values	•
Manual Compile Order		
VHDL Source Analysis Standard	VHDL-93	•
Enable Message Filtering		

Figure A.3: New Project Wizard—Device Properties Page

2. Adding Source Files to the Project

- 1. Click the Add Source button in the Design Panel toolbar to select the sources provided for tutorial.
- 2. In the next window, make sure that the association and libraries have been properly specified for the tutorial sources. Compare setting with those in Figure A.4.
- 3. Click OK.

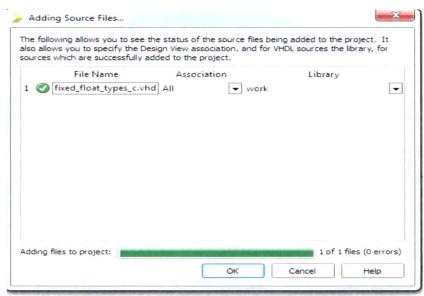


Figure A.4: Adding VHDL Test Bench

3. Launching a Behavioral Simulation

1. Now that the ISE project has been created for the tutorial design, we can proceed to set up and launch a behavioral simulation using ISim.

Setting Behavioral Simulation Properties

- ℵ To set behavioral simulation properties in ISE : In the Design Panel, selectBehavioral Simulation from the dropdown list.
- ★ We should now see the simulation processes available for the design in the Processes pane. (Refer to Figure A.5)
- 2. Right-click Simulate Behavioral Model under the ISim Simulator process and select Properties. The ISim Properties dialog box displays (Refer to Figure A.6).
 - ℵ In this window we can set different simulation properties, such as simulation runtime, waveform database file location, and even a user-defined simulation command file to launch the simulation.
 - ✗ For the purposes of this tutorial, we will disable the feature that runs the simulation for a specified amount of time.
- 3. In the ISim Properties dialog box, uncheck the property Run for Specified Time, and click OK.(Refer to Figure A.6)

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esign Wexe: Implementation Sehavoral Hierarchy Soru24jan2014 Concestuals cog244 Concestuals cog244 Concestuals cog244 Concestuals cog246 Concestual consug2101 Behavioral (consug2101 whd) Concentration concestual consug2101 whd) Concentration Conc	++ - # ×	Switch Name Property NU Use Custom Simulation Custom Simulation Com Run for Specified Time Simulation Run Time Use Custom Randform Con Custom Waveform Con Specified Top Like Homan	Command File mmand File 7 1000 ns name ne Janconfguration2001 anncon2001 anncon2001_sim_beh wdc Configuration File
		Lood gbi	7 Property dopley level: Sanctard 💽 7 Dopley switch names 🛛 Sanctard DK Cancel Sanct mep

Figure A.5: Process Pane

Figure A.6: ISim Properties Dialog Box

Now it is ready to launch the ISE Simulator to perform a behavioral simulation of the tutorial design. To launch the simulator:

In the Processes panel, double-click **Simulate Behavioral Model**. The ISim Graphical User Interface (GUI) (Figure A.7) will appear shortly after the design is successfully parsed and compiled.

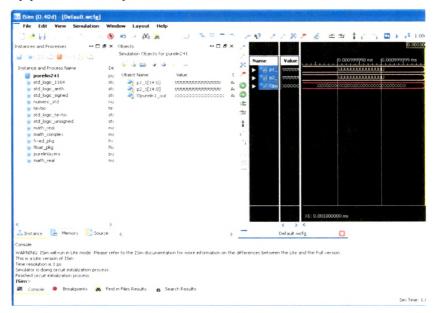


Figure A.7: ISim Graphical User Interface

A.2 Impact Setup

The Digilent Plug-in for Xilinx tools allows Xilinx software tools to directly use the Digilent USB-JTAG FPGA configuration circuitry. For 14.x, Xilinx Impact, ChipScope Pro, EDK Xilinx Microprocessor Debugger (XMD) command line mode, and EDK Xilinx Software Development Kit (SDK) are currently supported by the Plug-in. Refer to http://www.xilinx.com/ for more information about these Xilinx design tools.

Software Versions Tested:

- Xilinx ISE Design Suite Version 14.x only (Refer to http://www.digilentinc.com/ for versions of the plugin for later Xilinx ISE versions)
- Digilent Adept System 2.9 (or Digilent Adept Runtime 2.9 for Linux) or greater Supported Operating Systems:

Microsoft Windows 32-bit and 64-bit Operating Systems

Linux: Red Hat and CentOS 4, 5, 6 (x86/x64), and SUSE 11 (x86/x64)

ℵ Plug-In Installation

To begin, ensure that Xilinx ISE Suite (14.x only) and Digilent Adept System 2.9 (or greater) for Windows, or Digilent Adept Runtime 2.9 (or greater) for Linux, is

installed on the host computer. For Windows Systems also ensure that Microsoft Visual C++ 2008 Service Pack 1 Redistributable Package MFC Security Update is installed on the host computer. The Visual C++ Package is available for download at the following website: http://www.microsoft.com/en-us/download/details.aspx?id=26368

The plug-in files **libCseDigilent.dll** and **libCseDigilent.xml** must be copied to a location that is searched by the ISE Suite. Xilinx Impact is used to download bitstreams to FPGA boards. The following steps show how to use Impact with the Plug-in.

 Launch Impact, double click on "Boundary Scan", and select the "Cable Setup..." menu item from the "Output" menu.(Refer Figure A.8)

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Consoe O Errors 🤳 Warn Examine and change cable communic.			No Cable Connection - No File Open

Figure A.8: Cable Set up

Communication Mode		
Parallel Cable III	Platform Cable USB/II	
Parallel Cable IV	 Digilent USB JTAG Cable 	
	Ad lanced USB Cable Set	(4) (4)
ort:	TCK Speed/Baud Rate:	
OnbUsb/10054D131214	✓ Default Speed	-
Cable Location		
Local Host Nam Remote	e:	
Cable Plug in		
Open Cable Plug-in. Sel	ect or enter a Plug-in from the list be	low:
digilent_plugin		
OK	Cancel Help	

Figure A.9: Cable Communication Setup

- Select "Digilent USB JTAG Cable" for the "Communication Mode" as shown in Figure A.9.
- 3. The "Port:" drop-down list should now contain a list of available devices. Select a device to connect to. Click on "OK" and proceed.
- 4. Right Click in the "Boundary Scan" window to and then click on "Initialize Chain". (Refer Figure A.10)

∉ ISE IMPACT (P.15xf) - [Boundary Scan]			C D X
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APACT Point	Ragbe	de dak ta Add Dense er femaler (TAG shan	
APACT Processes ↔ □ ♂ × Available Operations are	Add Non-Xilina Device		
Create - 1987:1978ALT - Ligilent Flugini Serial Number: 2100354336 - 1987:1978ALT - Englient Flugini Franker Version 2025 - 1987:1978ALT - Digilent Flugini Flamater Version 2025 - 1987:1978ALT - Digilent Flugini (TAC Cleark Freedown) 2005 - 1987:1978ALT - Digilent Flugini (TAC Cleark Freedown) 2005 - 1987:1978ALT - Digilent Flugini (TAC Cleark Freedown) 2005 - Distribution (TAC Cleark Freedown) 2005 -	Industor Charr Cable Auto Connect Cable Setup Output File Type		•• 🗆 ð i
// *** BATCH CMD : setCable -target "digilent plugin DEVI) INFOLMARCT = Digilent Flugini Flugini Versioni 7.1.11) INFOLMARCT = Digilent Flugini Opening device : "SNICLIDO) INFOLMARCT = Digilent Flugini Deve Name: Digilent CTA) INFOLMARCT = Digilent Flugini Froduct Name: Digilent CTA) INFOLMARCT = Digilent Flugini Forduct Name: TIGODSHEDY	CE-SN:2102054336~4 : 5433674°. S-R91	: FREQUENCY+15000000*	
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1 Console 🔕 Errors 🔬 Warnings		Configuration Digiters /	

Figure A.10: Snapshot of Boundary Scan

5. Impact is now ready to communicate with the FPGA on the board. Now double click on program option by right click on target device or double click on program in "Impact Processes" Pane, Which will now program the FPGA Chip and display the message as shown in Figure A.11.

ISE (MPACT (P.15xf) - [Boundary Scan]	122000	The second second		0 0 X
File Edit View Operations Output	Debug Window Help			. 6.1
300	3 - 242			
MPACT Rows + 0 8 X				
SystemACE Create PROM File IPROM File Format. WebTalk Data		[Emar]		
MPACT Processes ++ C # X	xc3s500e	xc104s		
Available Operations are de Get Device ID de Get Device Signature/Usercode de Read Device Status	bypass TDO	bysess Boundary Scan	Identify Succeeded	
Console				•• • • # # >
<pre>/ INFO:IMPACT:1777 - Reading C:/Xilinx/14.1/ISE_DS / INFO:IMPACT:501 - '1': Added 1</pre>				
<pre>'1': : Manufacturer's ID = Xi. } INFC::MPACT:1777 - Reading C:/Xilinx/14.1/ISE_DS</pre>	/ISE/spartan3e/data/x	:3#500e.b#d		
) INF0:1MFACT:501 - '1': Added	Device xc3s500e succe:	afolly.		
done.				
PROGRESS_END - End Operation.				
Elapsed time = 1 sec. // *** BATCH CMD : identifyMPH	v			
parts the . identifying				
Console 🗿 Errors 🔔 Warrings				,

Figure A.11: Program Launch Window

A.3 Atlys[™] Board: Spartan-6 XC6SLX45 CSG324C

The Spartan-6 LX45 is optimized for high-performance logic and offers:

- ℵ 6,822 slices, each containing four 6- input LUTs and eight flip-flops
- ℵ 2.1Mbits of fast block RAM
- ✗ four clock tiles (eight DCMs & four PLLs)
- ℵ six phase-locked loops
- ℵ 58 DSP slices
- ℵ 500MHz+ clock speeds

Features:

- Xilinx Spartan-6 LX45 FPGA, 324-pin BGA package
- ℵ 128Mbyte DDR2 with 16-bit wide data
- ℵ 10/100/1000 Ethernet PHY
- ℵ on-board USB2 ports for programming and data transfer
- ℵ USB-UART and USB-HID port (for mouse/keyboard)
- * X two HDMI video input ports and two HDMI output ports
 - X AC-97 Codec with line-in, line-out, mic, and headphone
 - **X** real-time power monitors on all power rails
 - ℵ 16Mbyte x4 SPI Flash for configuration and data storage
 - ℵ 100MHz CMOS oscillator
 - **★** 48 I/O's routed to expansion connectors
 - ℵ GPIO includes eight LEDs, six buttons, and eight slide switches
 - ℵ ships with a 20W power supply and USB cable

A.4 Programming WSN Motes

1. Programmer's Notepad 2

MoteWorks includes a version of Programmer's Notepad (PN2) that is configured as a simple IDE for nesC code.

- X Steps for implementing WSN application on PN2
- 1. Open Programmer's Notepad from Start>Programs>Crossbow>PN
- 2. Open a nesC file within an application directory. (eg. MyApp.nc), and click on Tools > make MICAz. It can also be executed in the shell commands by clicking on Tools > shell and then typing the command in the dialog box. The "Output" section of the Programmers Notepad will print the compiling results to the screen as shown in Figure A.12.

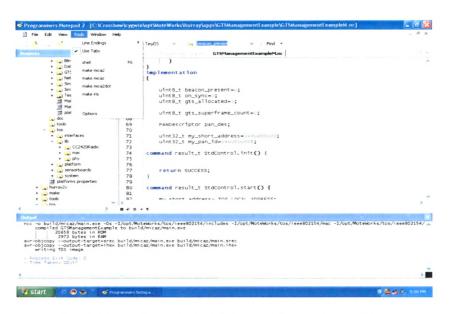


Figure A.12: Snapshot of Programming Notepad 2

After the compilation has completed one should see "writing TOS image" as the last line in the Output window. If we don't see this then we have made an error typing in one of our files.

3. Application can be installed to a Mote plugged into programming board using Programmer's Notepad. To install application:

Select Tools > shell. When prompted for parameters, type in **make micaz reinstalls mib520, com10.** The "Output" section of the Programmers Notepad will print the installation results to the screen as shown in Figure A.13.

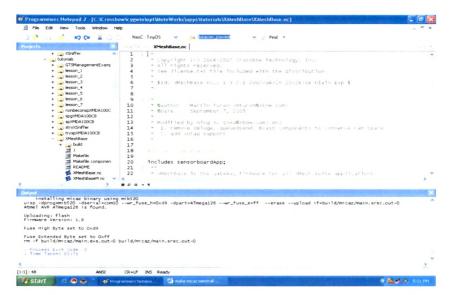


Figure A.13: Output Section of PN2

Appendix A

MoteWorks includes tool named MoteView that can be used to eavesdrop on messages sent over the Mote radios.

2. MOTE-VIEW

MoteView is designed to be an interface between a user and a deployed network of wireless sensors. MoteView provides the tools to simplify deployment and monitoring. It also makes it easy to connect to a database, to analyse, and to graph sensor readings. The key function of the program is to monitor the communications between the gateway and the individual motes. The data can be displayed using the MoteView program.

- 1. Start MoteView to configure the settings.
- 2. Start MoteView software, click on "Connect to WSN" icon in the upper left of the panel. The following Figure A.14 is the pop-up window, in the Mode tab, select acquire live data as operation mode.

Connect to WSN		X
	Mode Gateway Database Sensor Board	
2	1. Select Operation Mode	
Mode	Acquire Live Data	
	○ View Historical Data	
Gateway	2. Select Acquisition Type	
3	Decal	
	⊖ Remote	
	Custom	
Sensor Board		
	Cancel Done Done	

Figure A.14: Mode Configurations

3. In the Gateway tab (Figure A.15), select MIB520 from interface board, COM10 as serial port, and select 57600 as baud rate.

Appendix A

15 Moto	View	2.0							
0	\$	<u>()</u> 🖛 [Q					
		lodes	Data Command Char	ts Health Histogram	Scatterplot Topology				
	1d 00	2 Connect to W	ISN	State of the local division of the local div	A STATE OF THE OWNER.	A 198 199 19 19 19 19			_
	01 02		Mode Gateway	Database Sensi	or Board		7	rx path_cost parent_r 1024 0 11 210	1/3/2 1/3/2
		in the	3. Select Gate	eway				4 219	1/3/2
		Mode	Interfa	ce Board 🕺	8520 ×				
			Serial F	Port CC	w.11 ~				
		Gateway	Baud R	ate 57	500 👻				
		3							
Server	Herrow	Sensor Boar		anced Server Setting	\$		/3	2014 4 13:58 PM	> • • •
Server	wessag		Cancel		« Back Next >>	Done			
<u> </u>				Database: localhost	ybw da100 requits	MI8520: (COM11@57600	Thursday, February 1	13, 2014
H st	art	0 0 🐨	untitled2 - Paint	W unckled - Park	make micaz ro		Connect to W		

Figure A.15: Gateway Configuration

4. In the Database tab (Figure A.16), localhost is the database server; database name task was created during the PostgreSQL installation.

C.	4. Select Database to log to		
Mode	Available Databases	Current Datab	base
	localhost	Server	localhost
		Database	task
Gateway		Port	5432
		User Name	tele
2		Password	tiny
Database	•	•	
	Add Edit Remo	ve	
Sensor Board			

Figure A.16: Database Configurations

5. In the Sensor Board tab (Figure A.17), select XMDA100 from the application name drop list. Then, click "Done". MICAz nodes are flashing and MIB520 base station start to collect data from sensor nodes.

Appendix A

ŧ	Connect to WSN		
		Mode Gateway Database Sensor Board	
	i	5. Select Sensor Application	
	Mode	Application Name 🗰 🗸 🗸 🗸 🗸 🗸	
		Database Table Name	
	Gateway	View Alternate Table	
	3		
	Database		
	Sensor Board		
		Cancel Cancel Done	

Figure A.17: Sensor Board Configurations

The complete set up for WSN application is shown in following Figure A.18



Figure A.18: MICAz Nodes & Gateway Setup