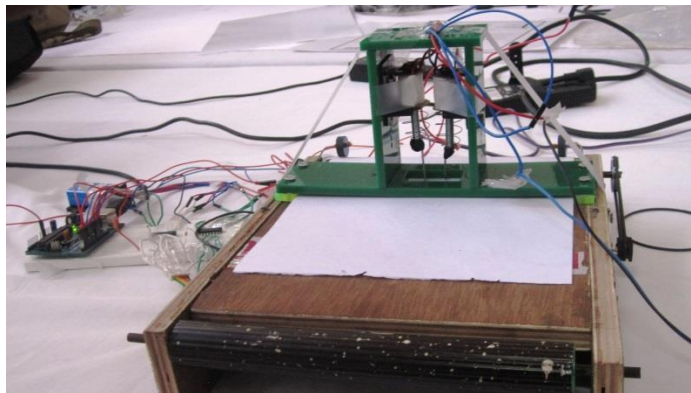


Darsh Shah  
*Selected Works*



## Keys2Dots: An innovative Braille Printer

Keys2Dots is a stand-alone printer cum typewriter system. This system takes input from USB keyboard and sends it to microcontroller. The microcontroller detects key strokes and converts the ASCII code into an equivalent Braille code. The Braille code is sent to printer with the help of relays. The printer has 2 spokes which punches 2 dots at a time. Solenoids are used for punching. Stepper motors provides the rotation of the paper. The current model works on AC source. Arduino was used as a microcontroller and the relays were taken from the door-bell.




Some of the beneficiaries of this solution are teachers who want to make course notes in Braille for visually impaired students or publication houses willing to print some books in Braille. This will also help to teach more number of visually impaired students which will ultimately help them to be independent.

*Tags: Arduino programming, Fablab machines, Mechanical Assembly, Rapid prototyping, Assistive Tech*

designinnovation  
DESIGN INNOVATION

## KEYS2DOTS

A low cost and compact Braille printer




**What:** It is a device which converts the text written on keyboard into Braille language and prints on paper.

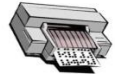
**Why:** Current printers use 6 dots and hence the user/writer requires to know Braille language. Also, other existing printers are very costly.

**How:** We are using a microcontroller to detect key strokes and convert the ASCII code into an equivalent Braille code. Then the Braille code is sent to printer. The printer has 2 spokes which punches 2 dots at a time. Solenoids are used for punching. Stepper motors provides the rotation of the paper.

**Benefits:** Low cost portable device. Useful for communication with deafblind people.

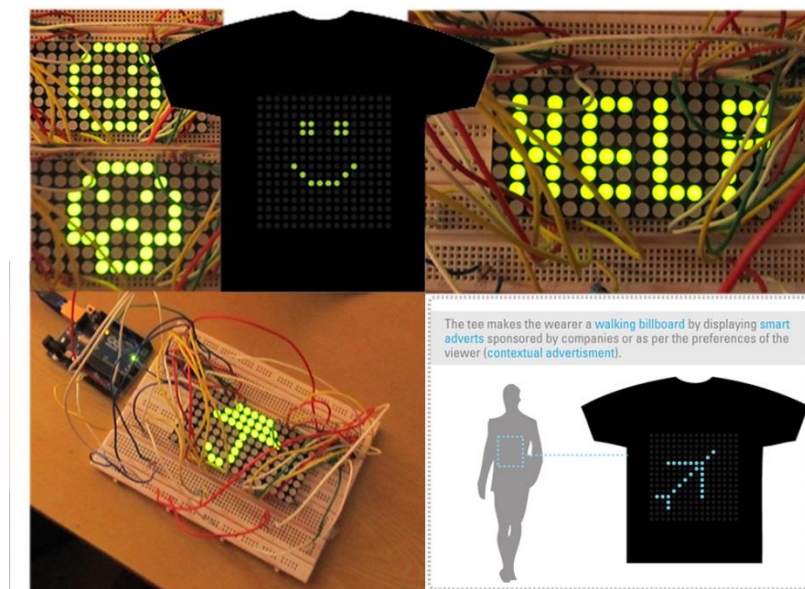


Made by:  
Adwait Kale, Anant Shinde, Darsh Shah, Nitin Bagul and Saurabh Dighe



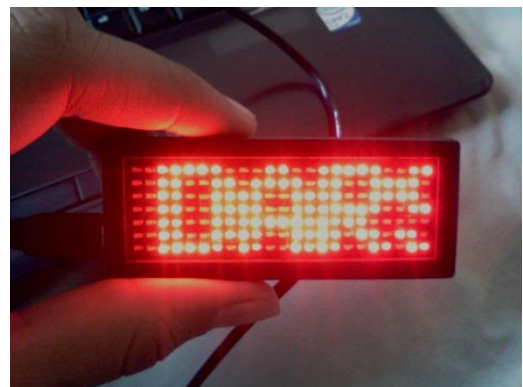
## smarT - An intelligent connected t-shirt

smarT is an interactive t-shirt developed for specially abled people. This t-shirt has a LED panel in front displaying text information. The final work is to read gestures via a head/shoulder mounted camera and display interpretation of gestures in form of text on the t-shirt. Also, the t-shirt is connected to internet and hence the display can be used for advertising. So, context-based/location aware advertisements would be on the t-shirt as the person moves around. Moreover, custom messages can be displayed on the t-shirt as per the mood of the wearer like slogans, trolls, and other similar things.



In the next version, we will use the below LED panel for display instead of LED matrix. One of the other goals of this work is to try to come up with a flexible display which can be stuck anywhere from clothes to bags to furniture.

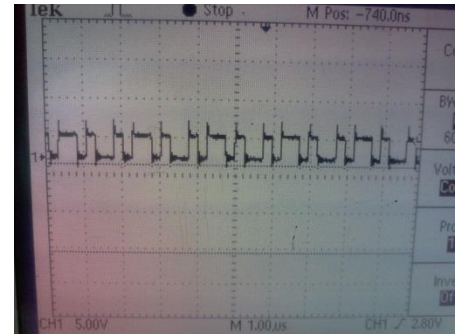
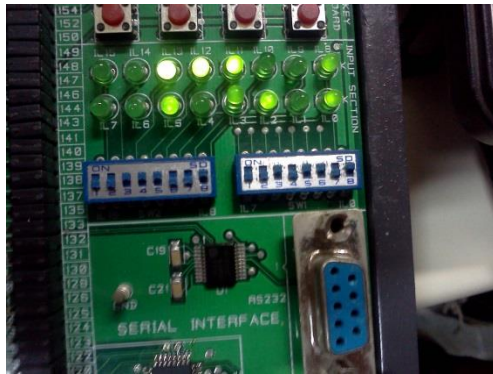
*Tags: circuit design, LEDs, arduino programming, rapid prototyping, assistive technology*



## Multi-Encoder System on FPGA

Implemented 3 encoding schemes - Manchester coding, Non Return to Zero Inverse (NRZI) and 4B-5B schemes in hardware.

Spartan 3 FPGA kit was used for the project. The user chooses the encoding scheme by selecting the proper combination of the input switches. The data is given via the 16 I/O switches on the FPGA board and the output is shown on the oscilloscope.

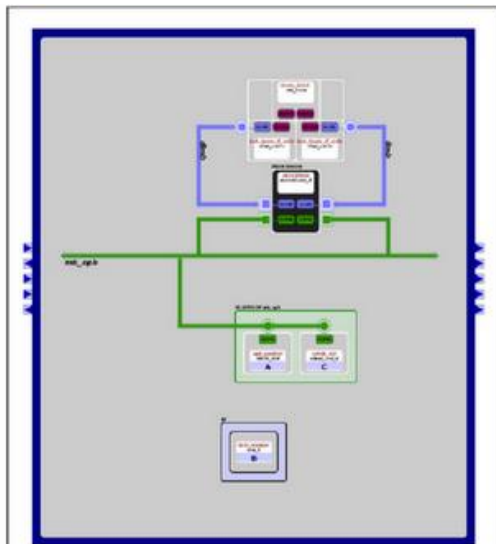


Used Verilog for coding on FPGA.

Tags: FPGA, Verilog, Encoding schemes.

## LCD as General Purpose IO using Microblaze soft processor core

MicroBlaze is a soft processor core designed for Xilinx FPGAs from Xilinx. As a soft-core processor, MicroBlaze is implemented entirely in the general-purpose memory and logic fabric of Xilinx FPGAs.



Using EDK 10.1 (Embedded Development Kit), we wrote a custom code to include LCD as a part of GPIO on Spartan 3E FPGA. We used the OPB bus i.e. On-chip Peripheral Bus to connect the LCD as a peripheral.

We also explored Xilinx LWIP (Light Weight IP) to make a network communication and to send a packet between the FPGA and PC using Ethernet.

Tags: Microblaze processor, EDK, FPGA, C programming

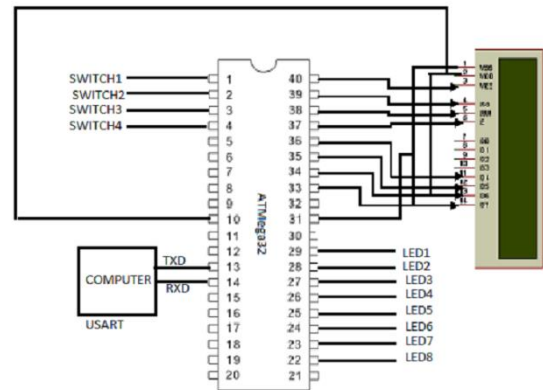
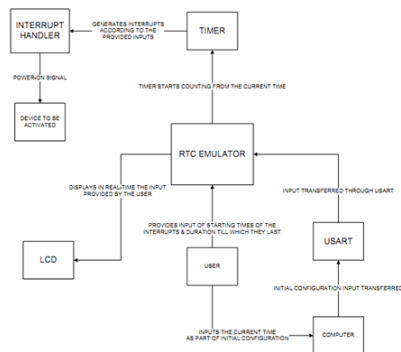


## Real Time Clock Emulator based System Actuator

We implemented a Real Time Clock in software for doing a task based on the time of the day.

Using Atmega32 controller, we set the timer1 at 8MHz frequency and used switches for time input and LCD for output.

The user enters the time at which the system should start, for how much time to be on, after what interval should it restart and how many times per day it should run.



We added the deviation in seconds to the software clock in order to maintain sync with actual clock. The output is connected to motor, which runs when current time=desired time. Various C codes for microcontroller is uploaded to <https://github.com/darshshah/ATMega16-Microcontroller-Codes>

Tags: Atmega32, RTC, C programming, circuit design.

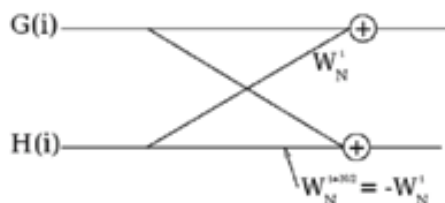
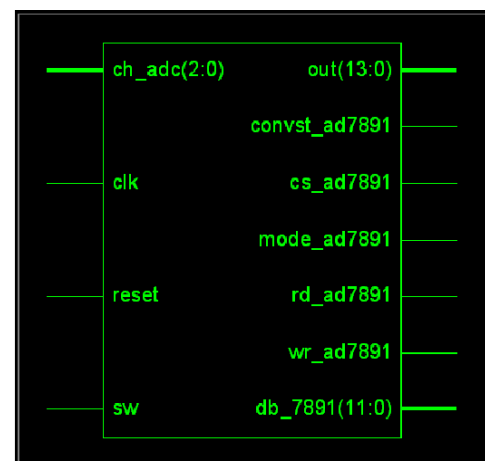
## Solving Discrete Fourier Transform on FPGA

We implemented a custom 4 point DFT solver using radix 2 FFT butterfly algorithm.

Inputs were taken from Function Generator and sampled via ADC and results were displayed on CRO and the LEDs.

The code was written in Verilog and implemented on FPGA. We optimized the code after running various routing analysis and also power analysis.

Tags: DFT solver, Verilog, FPGA, Optimizations





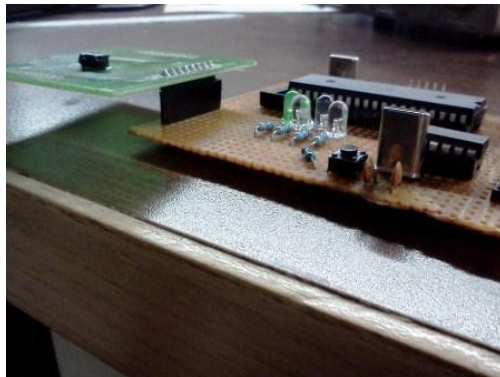
## OpticalCENSE

The aim of this project was to make a Wireless Optical Sensor Network Design for a Conducting Chamber. This project was sponsored by National Fusion Program, Board of Research in Fusion Science, India, where we were assigned the task of designing a wireless sensor network which would facilitate viewing of pre-fusion condition inside a Tokamak, before the nuclear fusion takes place.

The sensor nodes were to put in a conducting chamber of a nuclear fusion reactor and the communication between the nodes was done using IR instead of RF. The benefit of Infrared communications is that it is Line of sight communication and does not suffer from multi path fading effects.



I tested the old design of the sensor node and found that several optimizations are possible. Hence, during the research internship period, we made use of MCP2120 to double the data transfer. The IR transceivers follow IrDA protocol and hence to check the compatibility of the new IC with the modulator/demodulator, we soldered the circuit on general purpose PCB.



As a research assistant working on this project, we tested NVRAM with Atmega1281 process. We designed power management circuit to supply voltage to the board.

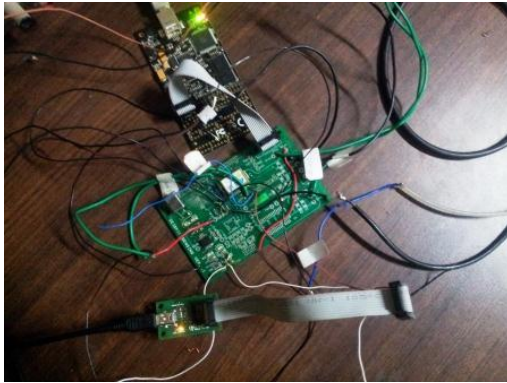
Once the test on PCB was successful, the final design and layout was made in OrCad and a custom PCB was fabricated.

Testing of the new sensor node was also done as a part of the project.

*Tags: Sensor Network, OrCad, Circuit design, Testing*



## SeismicCENSE: Interfacing ADS1255 with Zigbit



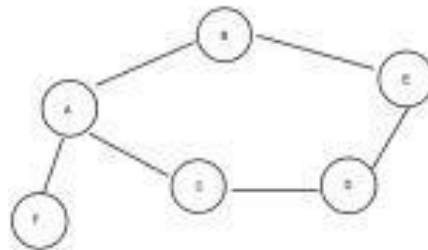
The aim of SeismicCENSE project was to calculate the seismic activity on Moon. My task was to take input from ADS1255, a 24 bit Analog to Digital Converter and send the data to the master mode using Zigbit.

We used AVR Dragon for JTAG programming of the node. The response from the ADC was seen on the GTK Terminal by using FT232 and serially transferring data to the computer using USB.

*Tags: ADC, JTAG programming, AVR Dragon*



## Load Balancing Transport Protocol for WSN



The task was to make an optimized protocol for Wireless Sensor Networks. It included designing of the protocol along with its simulation in NS2.

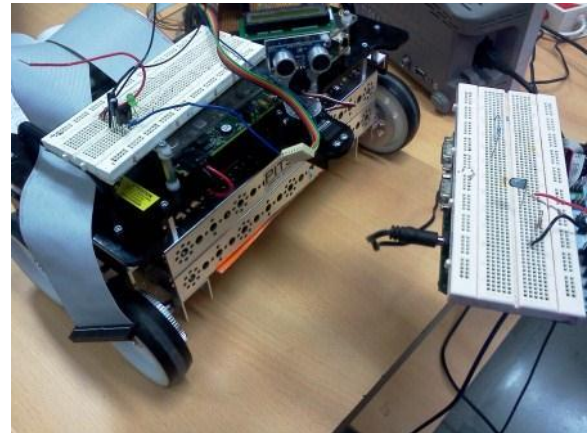
Looking at various routing mechanism, I found that using a reactive i.e. on demand routing protocol is better than a proactive protocol. So, as Dynamic source routing was already implemented, we modified DSR and introduced Load balancing into it. The source node makes the decision on which route to choose for optimized load balancing. I modified the source code of DSR and implemented my version in NS2. We also researched on the possibility of adding Data aggregation techniques in the modified DSR.

*Tags: DSR, Protocol Design, NS2*

## Infrared controlled NI sbRIO robot using LabView

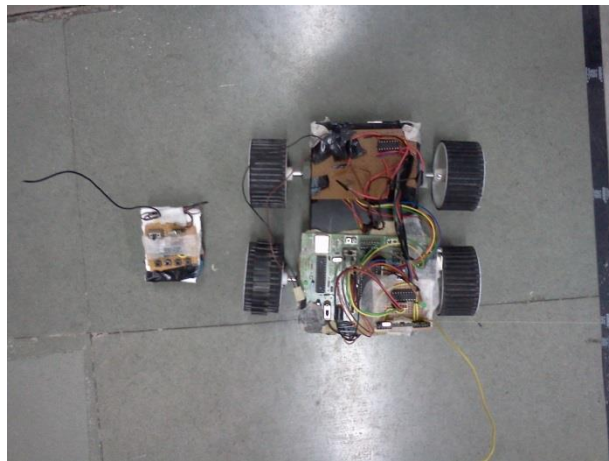
We were given a task to control the National Instrument's sbRIO robot wirelessly using Infrared. The coding for the robot's FPGA is doing using LabView.

We made a receiver module containing TSOP1738 and connected it to the FPGA on the robot. The transmitter had an IR led connected to STK500. The IR led modulated the data sent to it by microcontroller at 38 KHz and send it to the receiver. For movement in different directions, different code is sent via the STK500.



*Tags: Robot, LabView, Infrared, Circuit Design*

## Radio Frequency controlled robot



The task was to wirelessly control a robot and move it around. To achieve this task, I made use of 315 MHz RF transmitter and receiver modules. I used HT12E encoder chip and connected it to 4 push button switches. The data out was connected to the 315 MHz transmitter. The receiver was kept on the robot and was connected to the HT12D decoder chip. The output of the decoder chip was given to the microcontroller.

Using this configuration, the information of the state of the 4 switches was transmitted

wirelessly. The microcontroller had a code which checked the state of each switch and if pressed, does the appropriated action. For eg., on pressing sw1, robot will move forward. sw2 will make it move backward and so on.

Used custom ATmega32 uc board, 315 MHz RF transmitter-receiver modules and a robot chassis. Made custom PCB by soldering the encoder/decoder ICs along with switches.

*Tags: Robot, RF, Microcontroller, soldering*



## FastCV

At Qualcomm, I am currently working on FastCV, a computer vision library by Qualcomm, making test APIs for FastCV and exploring ways to test these on different hardware platforms. Also, I am building an automation suite for testing using Perl. I write end-to-end apps in C++ and use Valgrind to detect failing scenarios related to memory profiling and rectify them.



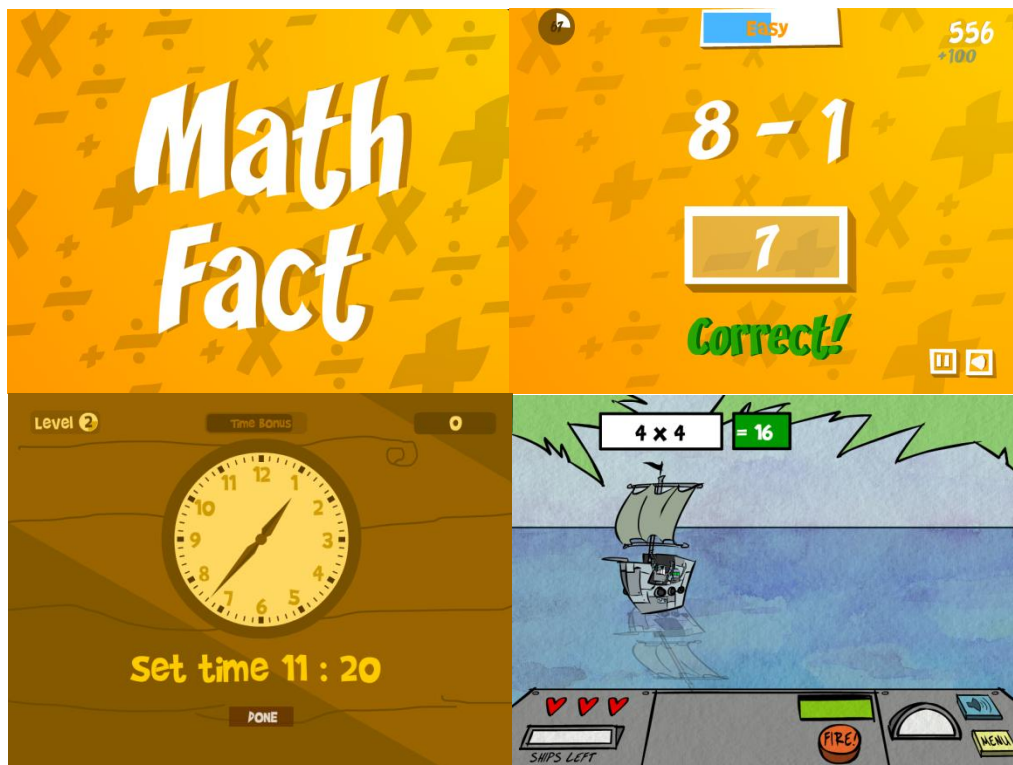
<https://developer.qualcomm.com/mobile-development/mobile-technologies/computer-vision-fastcv>

Tags: FastCV, C++ programming

## Educational Flash Games

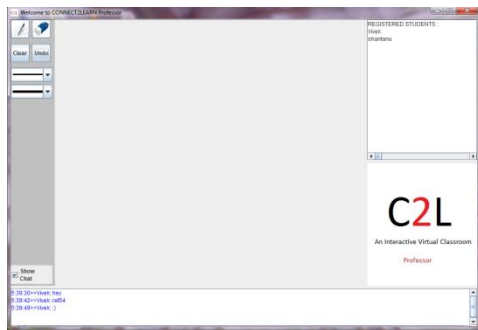
As a game developer and design intern at Playpower Labs Pvt. Ltd., I made 3 educational games in flash using Actionscript 3.0 using PureMVC framework for K-12 students. One of the games is hosted at <http://goo.gl/q6wSM>.

Tags: Game Development, ActionScript Programming, Designing



## Connect2Learn: A Virtual Classroom

Connect2Learn is a outcome of my Software Engineering course. We made a working prototype of virtual classroom system using Java.. The system comprised of 2 parts. One was the teacher side and other was the student side. Our website generated a random multicast IP address and port number to which the teacher will connect. The teacher side has an intuitive UI along with a chat window beneath it. The student connects to the same multicast IP address and can view whatever the teacher is scribbling on the whiteboard. We developed a novel algorithm which takes snapshots of the whiteboard at intervals defined in real time, then compresses the image, and sends the image to the student side using Real-Time Transport Protocol (RTP). We used multicast protocol because multiple students can connect to



same teacher side without making the network congested. The algorithm is defined in such a way that there is no apparent lag between the student side and teacher side. The audio is also sent via RTP. We observed that it saves bandwidth over the traditional video conferencing solutions while giving the same quality and experience.

*Tags: Java programming, RTP, Software*

## Playpower Foundation Games



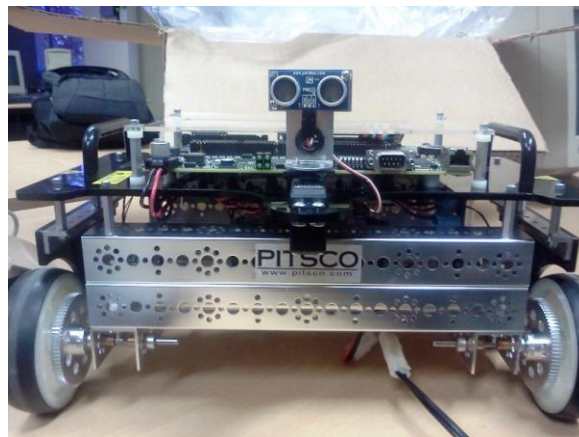
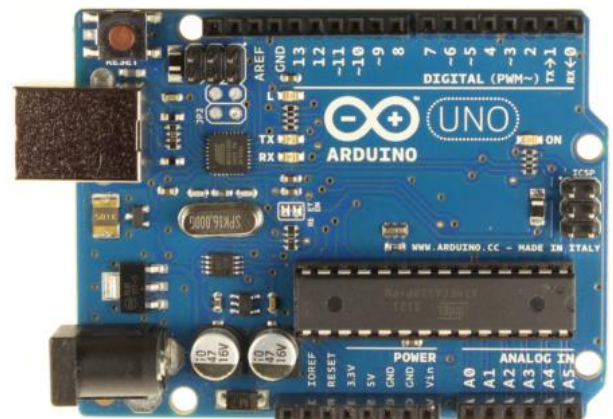
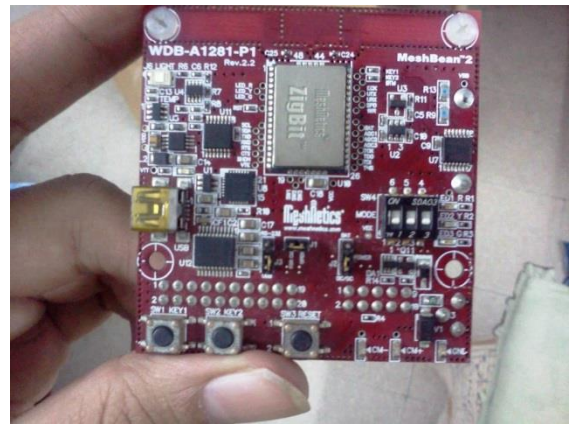
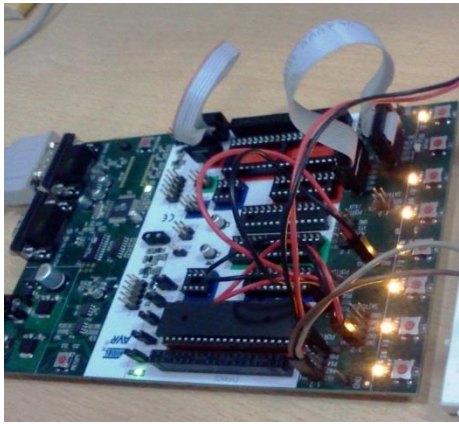
Playpower Foundation makes fun, affordable and effective learning games on \$10 computer platform. It is based in Carnegie Mellon University, USA.

I was a game developer at Playpower. My duties were to write assembly code for 6502 processor and make game. I used bank switching to fit the whole game in 32 KB ROM. I made 3 games - Hanuman Warrior Typing game, Hanuman Quiz game and Malaria game. These games were tested in Ahmedabad, Mumbai and Bengaluru.

*Tags: Game Development, Playpower, Assembly coding.*

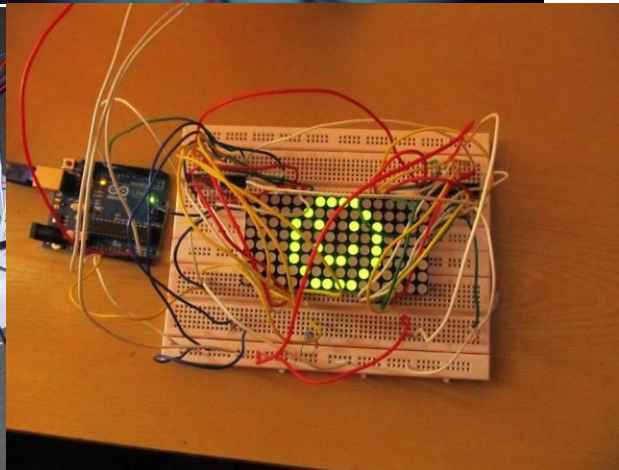
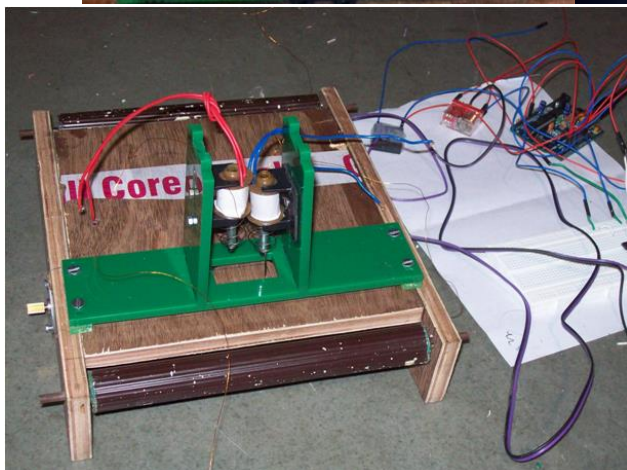
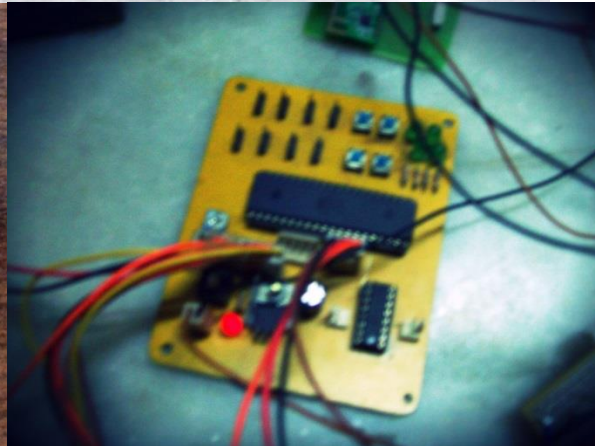
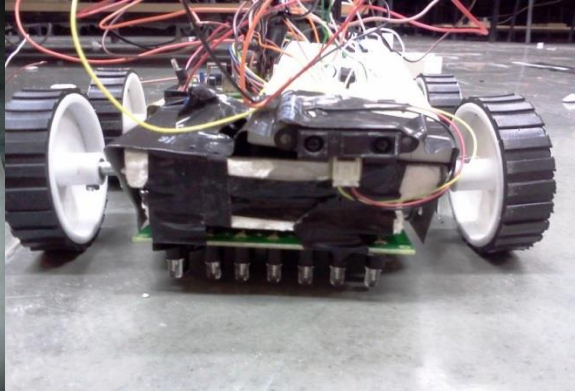
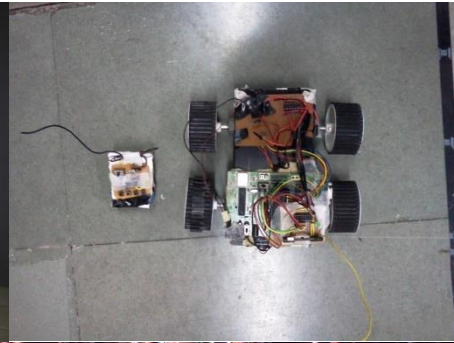


I have worked/played/used





I created/designed/soldered





I have used/know/work with

