Group IV

Multi Touch Poker Table$_{MTPT}$

for the iPhone

Critical Design Review

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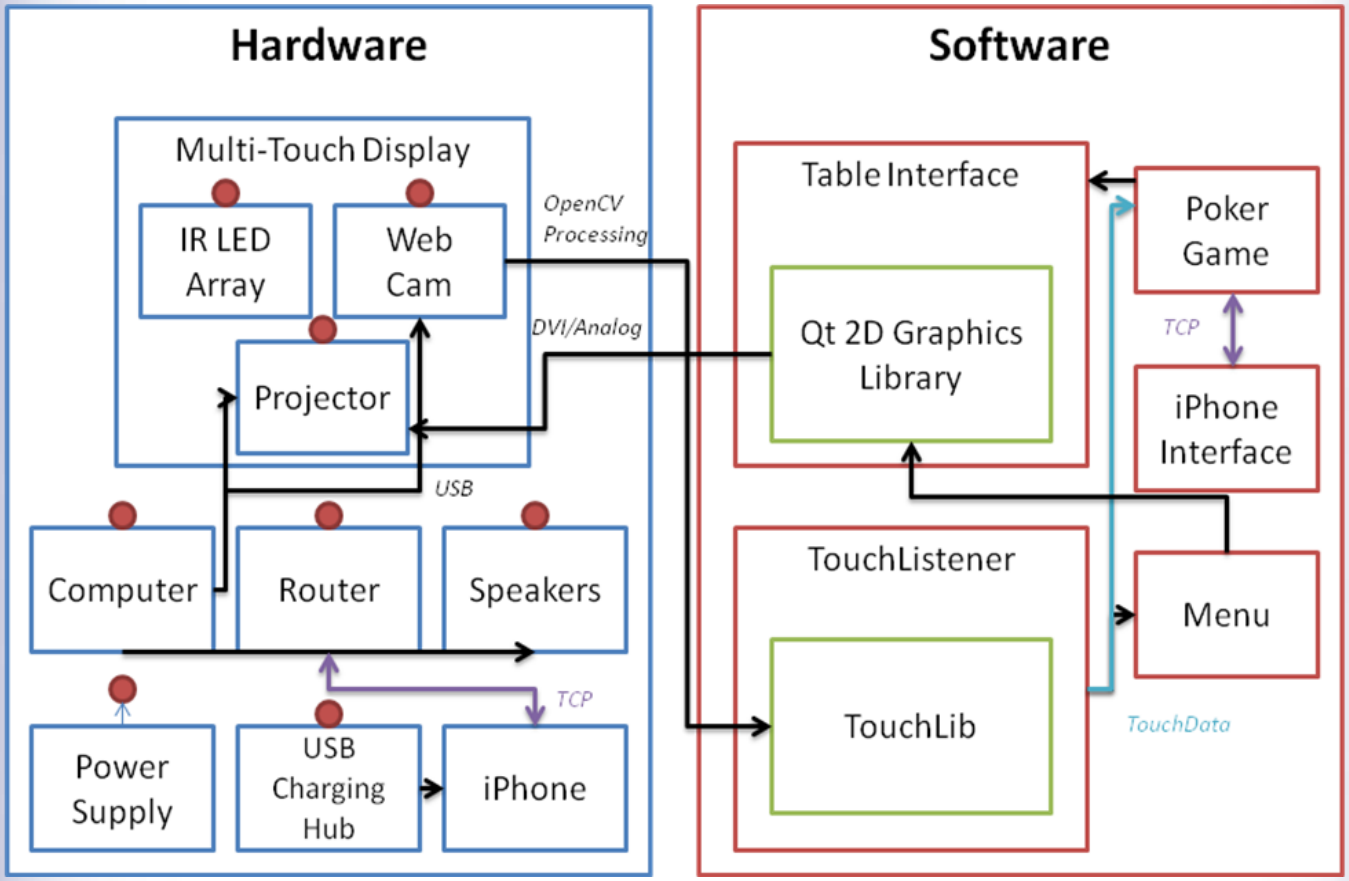
Project Description

- Multi-Touch screen to allow four users to enjoy a game of Texas Hold'em using an iPhone/iPod Touch

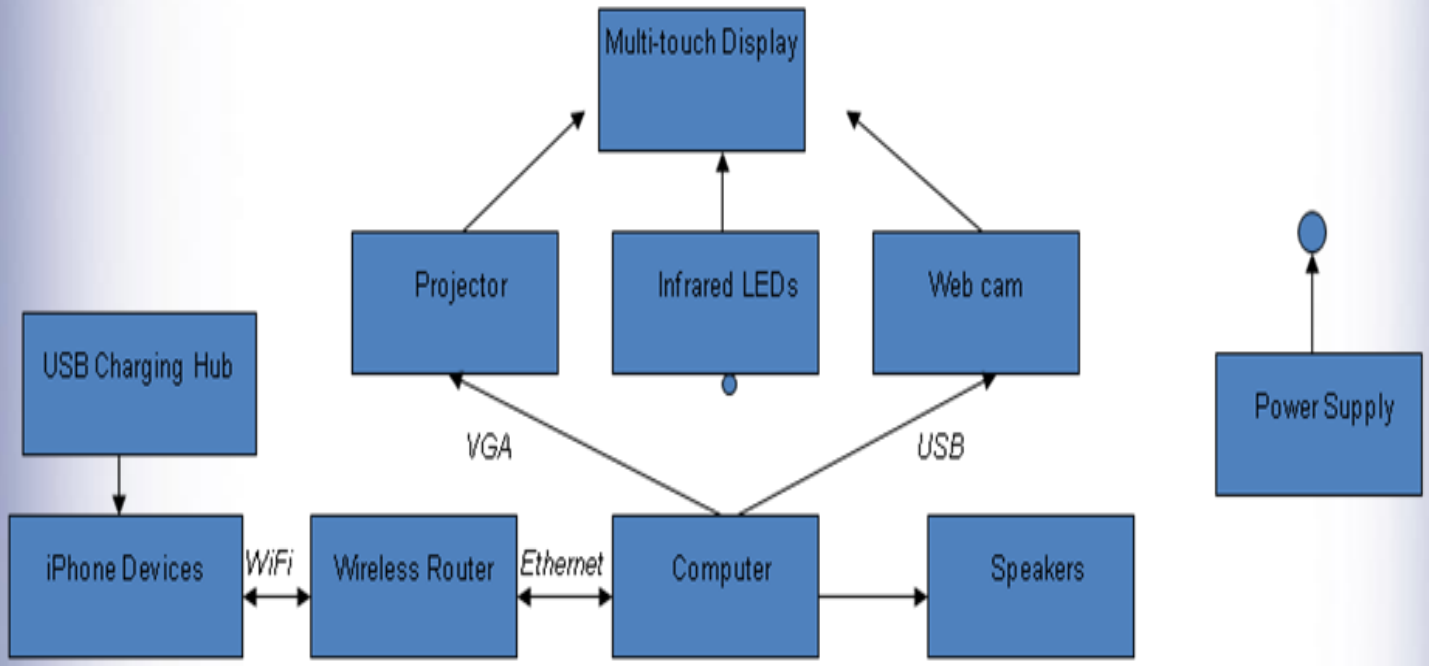
Goals and Objectives

- To explore alternative multi touch techniques
- To create an entity that will compliment a public environment such as a café or restaurant
- To create something for people to enjoy
- To learn basic constructs of iPhone development
- To become more proficient in c++ development

System Block Diagram

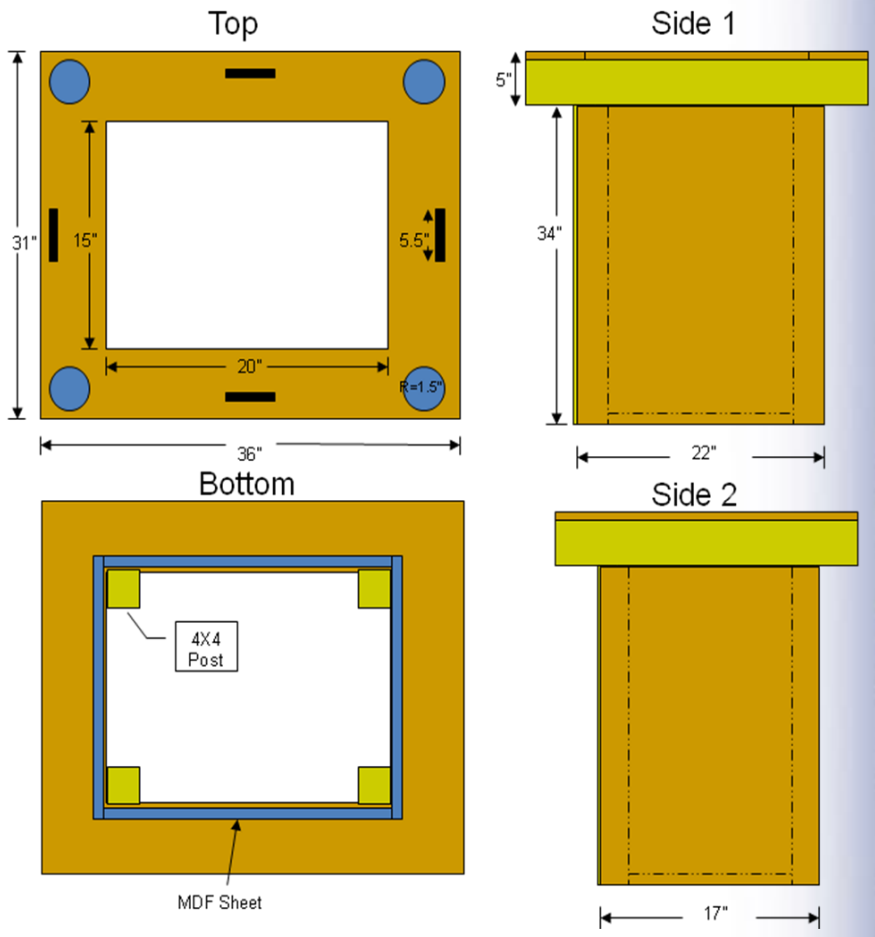


Hardware Components



Framework

- **GOALS**
- **Phone holder with charging capability**
- **Coffee cup holder to limit spills**
- **REQUIREMENTS**
- **25” screen**
- **Height > 34”**

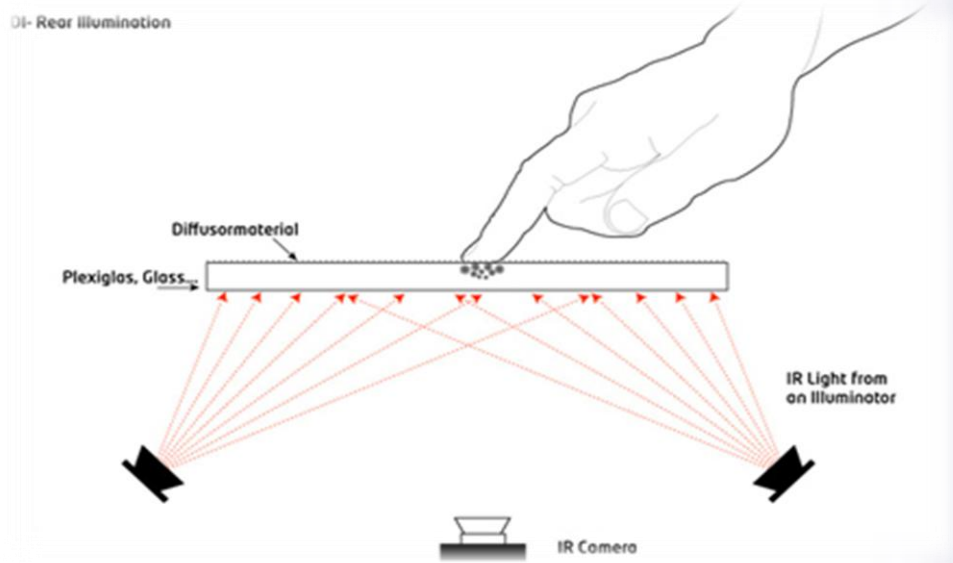


Multi-Touch Technique

- Four Techniques
  - Frustrated Internal Reflection (FTIR)
  - Rear Diffused Illumination (DI)
  - Laser Light Plane (LLP)
  - Diffused Surface Illumination (DSI)

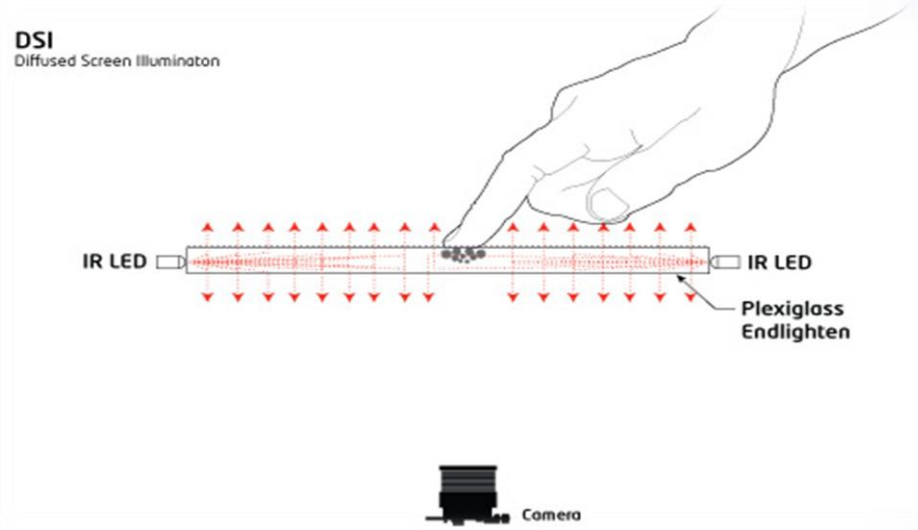
Multi-Touch Technique(cont)

- Rear DI
  - IR Illuminators
  - Object detection
  - Increase false touch



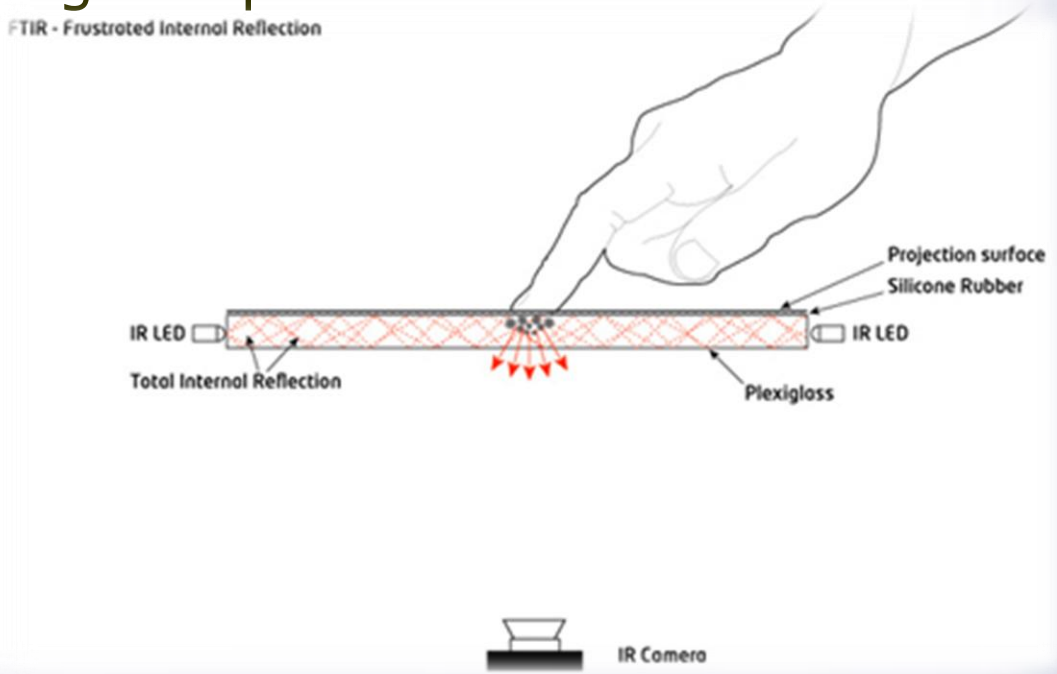
Multi-Touch Technique(cont)

- DSI
  - Material has mirror-like particles that reflect light
  - High Sensitivity
  - Expensive ($500 sheet)



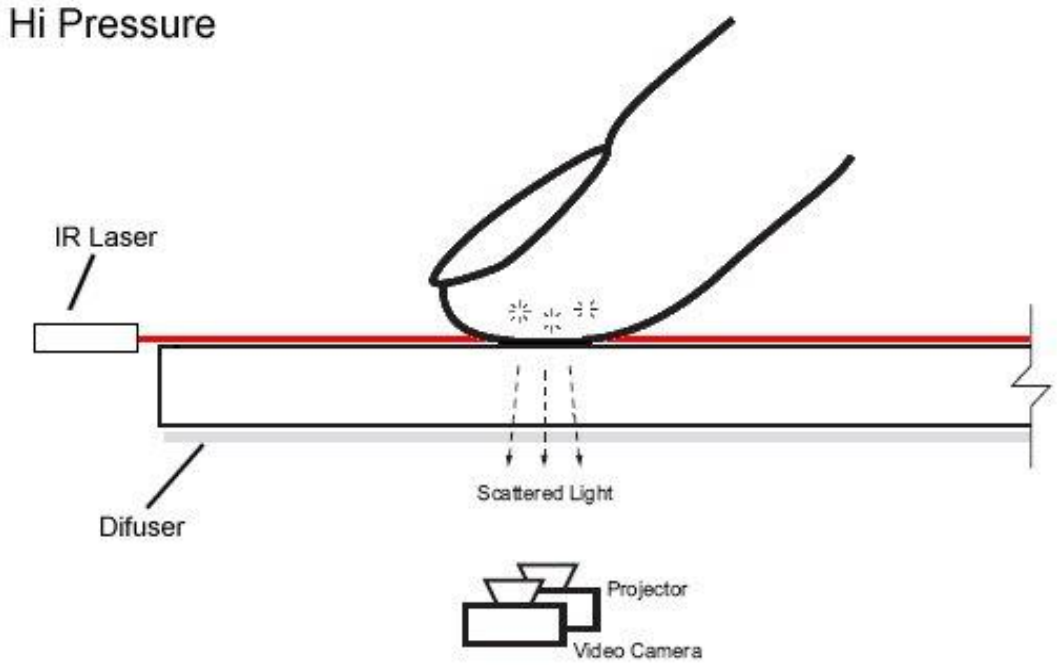
Multi-Touch Technique(cont)

- FTIR
  - IR light flooded through Acrylic surface
  - High sensitivity
  - Long setup time



Multi-Touch Technique(cont)

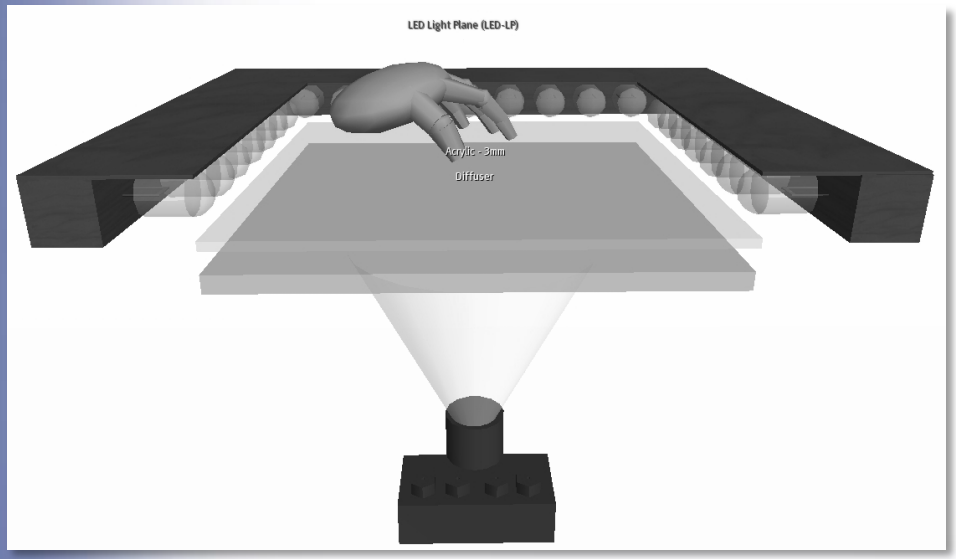
- LLP
  - Laser positioned above surface
  - Easy setup
  - Laser Orientation crucial



Multi-Touch Technique(cont)

Technique Decision Matrix

Elements	FTIR	Rear DI	LLP	DSI
Object Detection	4	1	3	2
Pressure Sensitivity	1	3	4	2
Contrast	1	3	2	4
Setup Time	3	4	1	2
Price	1	3	2	4
Total Score	11	14	13	14



- FTIR technique
  - Rigidity
  - Sensitivity

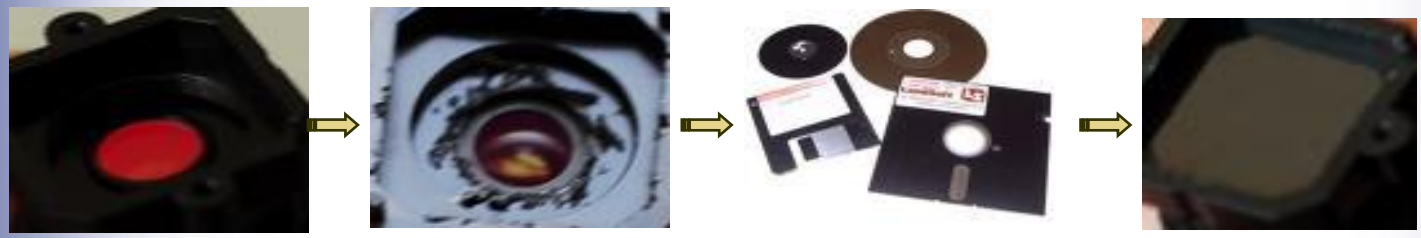
IR Camera

- GOALS
  - Min. Touch response delay
  - High touch accuracy
- REQUIREMENTS
  - minimum resolution of 640x480
  - frame rate of at least 30 FPS
  - transfer data at a minimum of 480 Mbits/s

Product Discription	Manufacturer/Website	Price $	Procurement Status
Playstation 3 Eye, USB 2.0, 640 x 480 @ 60 fps ¦ 320 x 240 @ 120 fps	Dell	$34.99	AQUIRED
Unibrai Fire-I digital camera, IEEE 1394 (FireWire), 640 x 480 @ 30 fps	Office Depot	$104.99	
Xbox Live Vision Camera, USB 2.0, 640 X 480 @ 30 fps	Newegg.com	$24.99	
Logitech Quickcam Communicate STX Web camera, USB 2.0, 640 x 480 @ 30 fps	Newegg.com	$34.99	

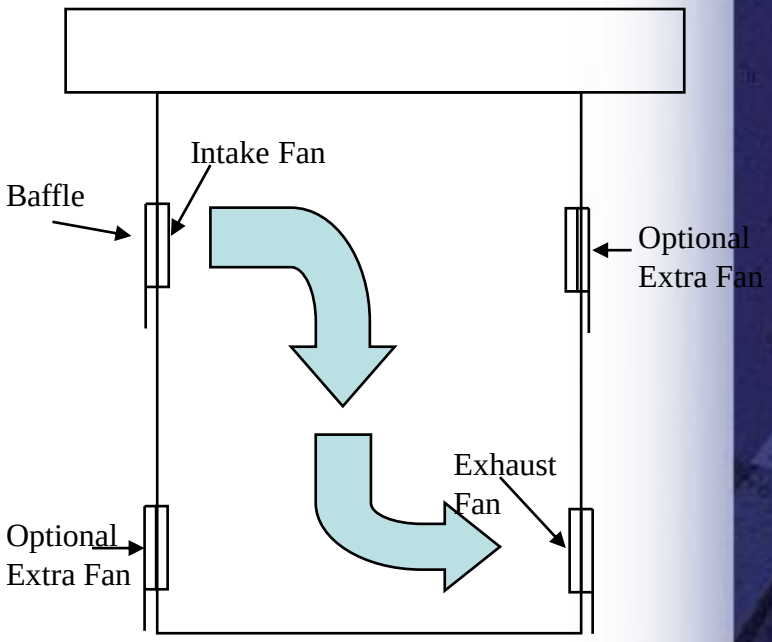
IR Camera(cont)

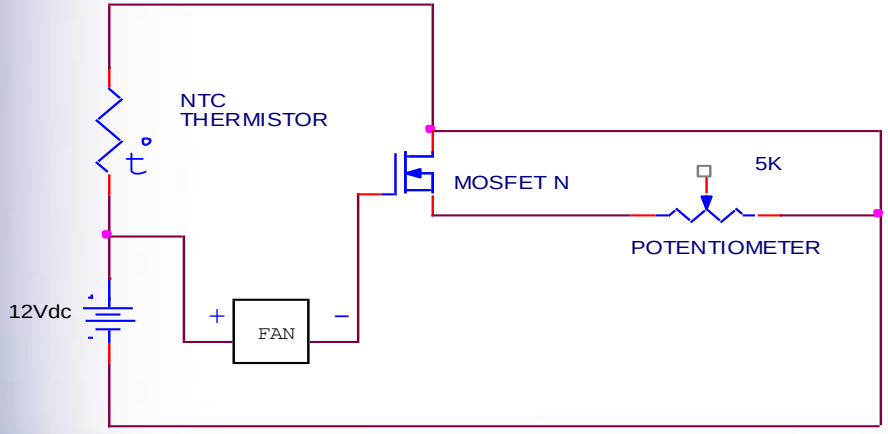
- PROBLEM
  - Web cams record in visible light spectrum
  - We need camera to record in IR spectrum
- SOLUTION
  - Disassemble Web cam
  - Remove IR Filter
  - Install Bandpass Filter (Magnetic tape)



Temperature Control

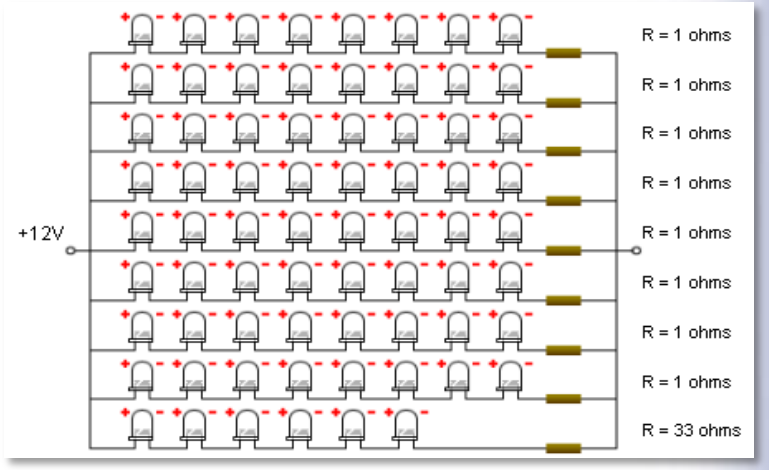
- Requirement = compartment Temp < 90°F
- 2 Yate Loon Fans (120mm, 1650rpm, .3A)
- Temperature sensor
  - Thermistor
  - 5K Potentiometer
  - N type MOSFET

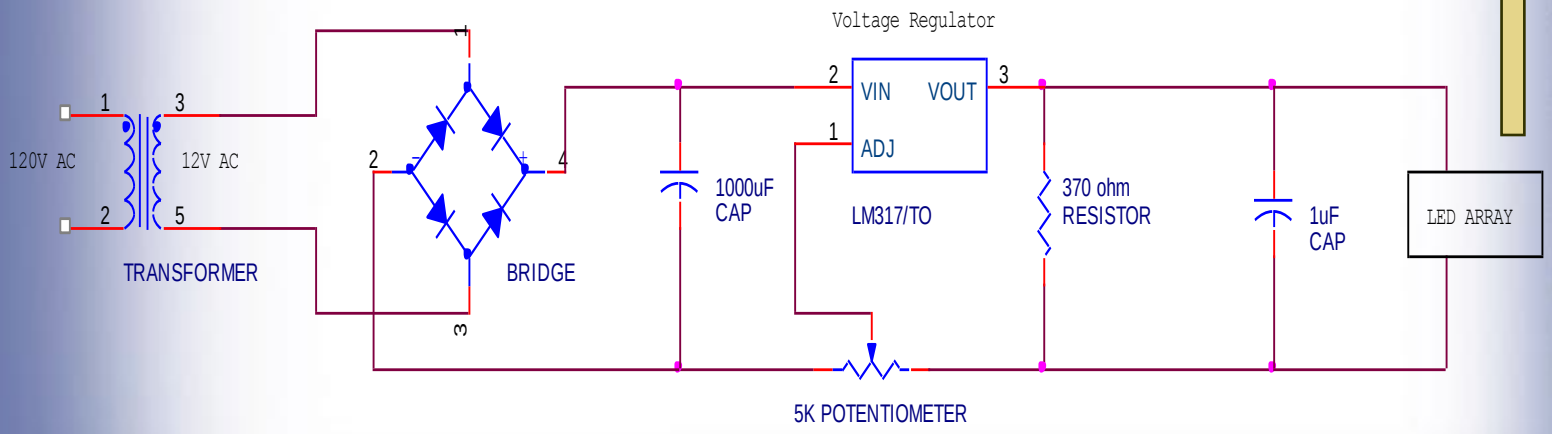




LED Power Supply

- 70 (100mW) IR LED's
- Using Ohm's Law and Voltage/Current divider
  - Total power dissipation = 10910 mW
  - Total current draw = 900 mA
- PS uses transformer, bridge rectifier, cap, voltage regulator, potentiometer
- Peak output of PS = 1A

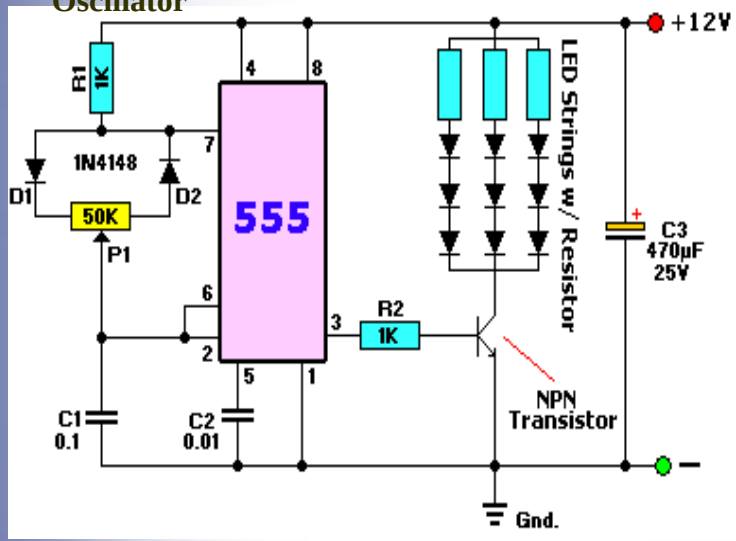


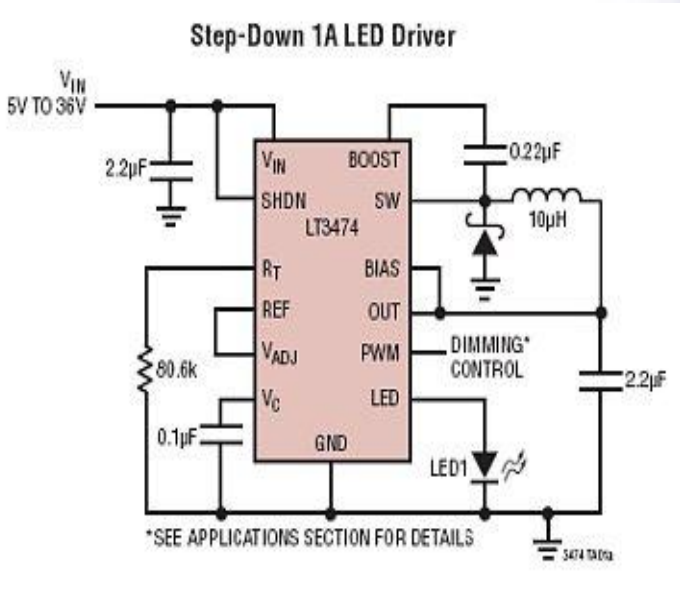


LED Power Supply(cont)

- Goal set to regulate LED intensity for light sensitivity
- Analog or PWM controller
- 555 timer max load current = 200mA (need 900mA)
- LT3474 ? Any suggestions

Pulse Width Modulator with NE555 Timer Oscillator



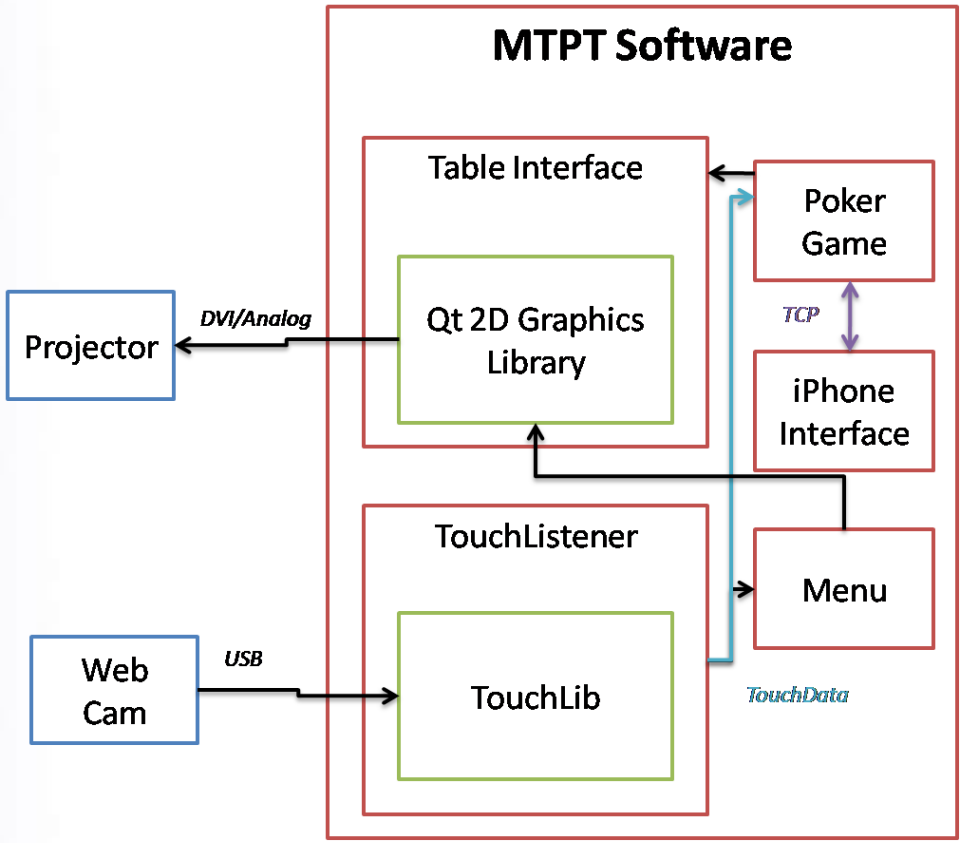


Hardware Test Plan

Hardware Progress

Software Block Diagram

- Input-Captured image from webcam
- Output-Graphics on touch screen



Software Requirements Specification Summary

- Poker Game
  - The MTPT will support Tournament style No Limit Texas Hold'em Poker.
  - The game will support from two to four players.
- Restaurant Menu
  - The menu can be viewed anytime during the game
  - Only one menu will be visible

Software Requirements Specification(cont.)

- Table Interface
  - Game will prompt user to start when at least 2 people join
  - Chips will be displayed on the table
  - Community cards will be displayed on the center of table.
  - The interface will display the following game information during the course of the game
  - The interface will execute the player actions(bet,check,fold) with touch commands

Software Requirements Specificatio(cont.)

- iPhone Interface
  - The following iPhone and iPod Touch devices will be supported:
  - iPhone EDGE, 3G, 3GS
  - iPod Touch 1st Generation, 2nd Generation
  - The MTPT will interface with up to 4 iPhone/iPod Touch devices.
  - Hole cards will be displayed on the iPhone/iPod Touch devices.

Software Libraries

- Qt (4.5.2)
  - Open Soucre C++ application and User Interface Framework
  - Ease of data types/structures, graphics
- Touchlib
  - Processes input video from web cam
  - Sends touch events to application
    - E.g. “Finger Up, Finger Down”
- PokerSource
  - Poker card/hand representation
    - 64-bit Hand Mask
  - Poker hand evaluation

High Level Design

- (Up to) Seven Threads
  - PokerExec
    - Controls game state
  - PokerPlayer(One per player)
    - Responsible for sending/accepting data from iPhone
  - PokerServer
    - Responsible for listening for initial iPhone connections
  - TouchListener
    - Controls/receives touch inputs from user on table
- Graphics
  - Utlizing Qt's Graphics View Framework
- iPhone Communication
  - Will use TCP to send/receiver packets

Card Representation

- Lower level
  - StdDeck_CardMask using Pokersource types
    - Masks may be OR'd together to make hands
- Hand Values
  - Hand values may be calculated for a five card hand out of 7 cards(2 hole cards, 5 community cards)

AKQJ T987 6543 2XXX AKQJ T987 6543 2XXX AKQJ T987 6543 2XXX AKQJ T987 6543 2XXX

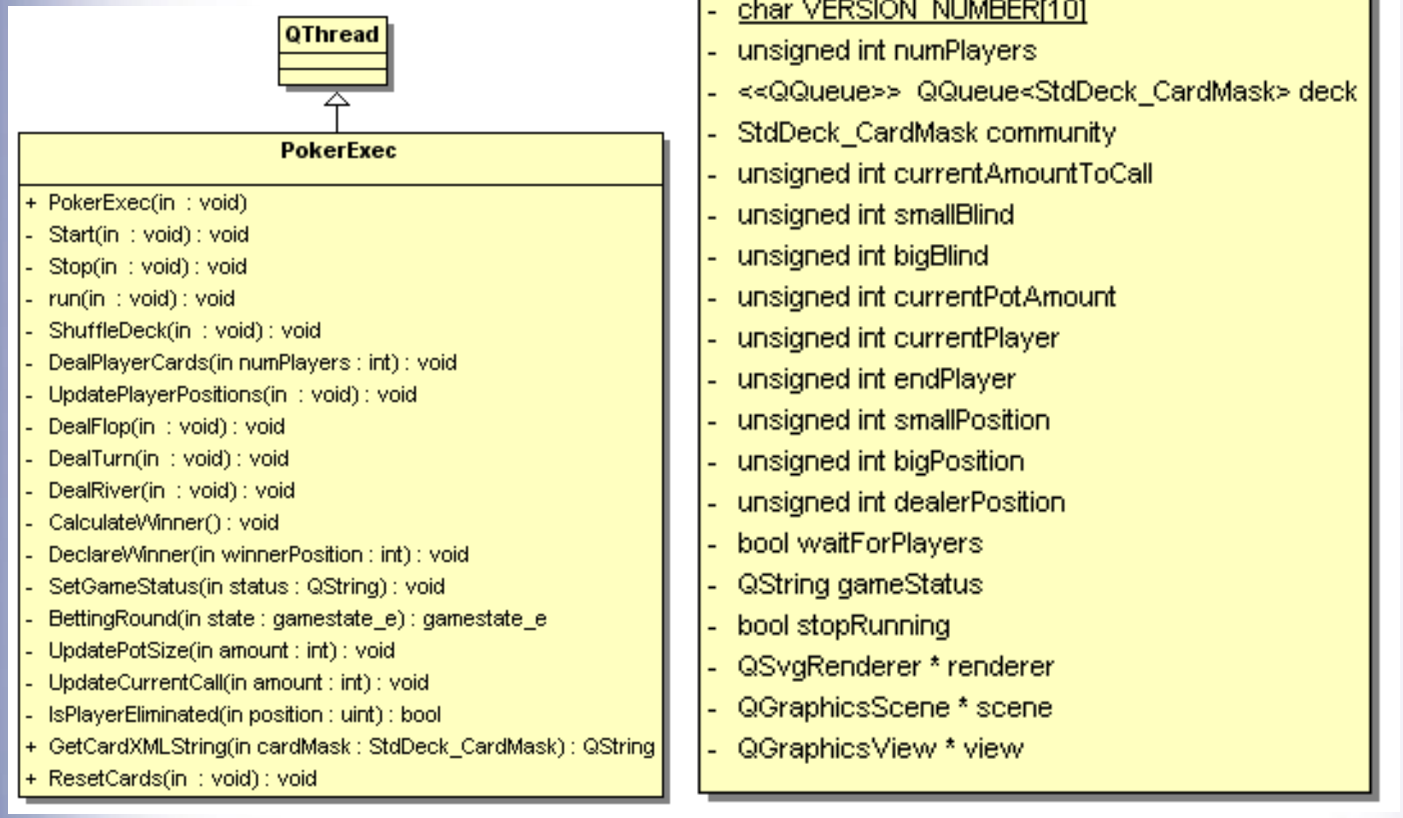
Spades
Clubs
Diamonds
Hearts
Unused

Detailed Design

- PokerExec Class
  - Main exec of software
- PokerPlayer Class
  - Holds crucial information for a player
  - Responsible for handling data to/from iPhone
- PokerCardGraphicsItem Class
  - Utilizes Qt Graphics library to help display .svg(scale vector graphic) cards
- TouchListener Class
  - Thread to handle touch events

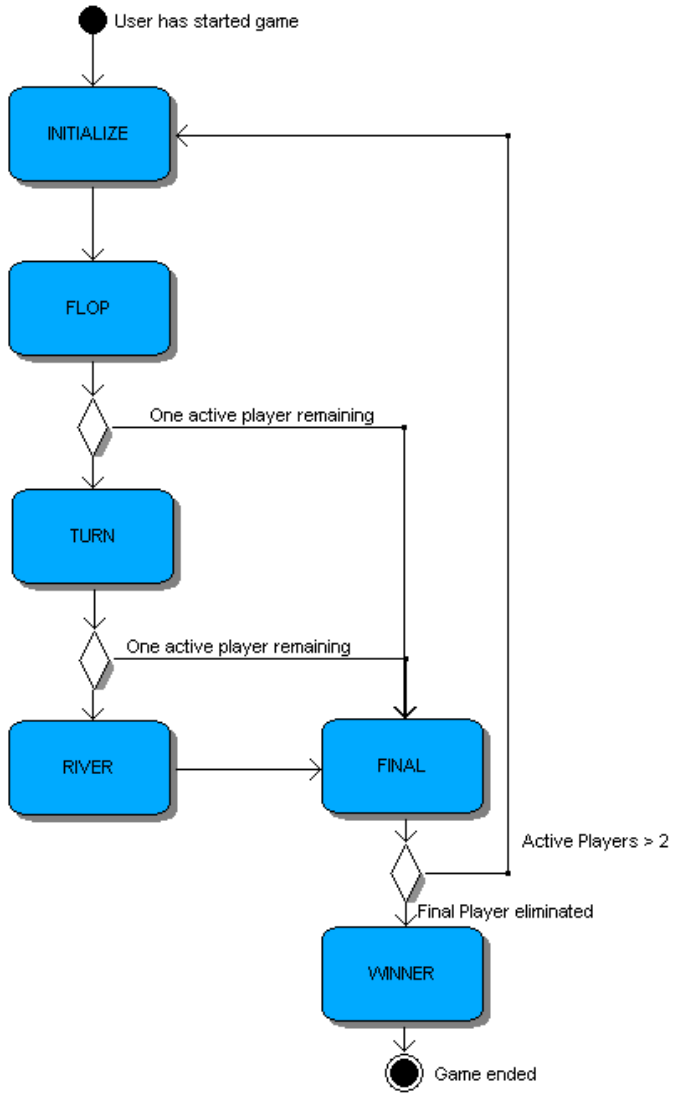
PokerExec Class

- Class Diagram
  - Operations(left),Parameters(right)
  - Extends Qthread class



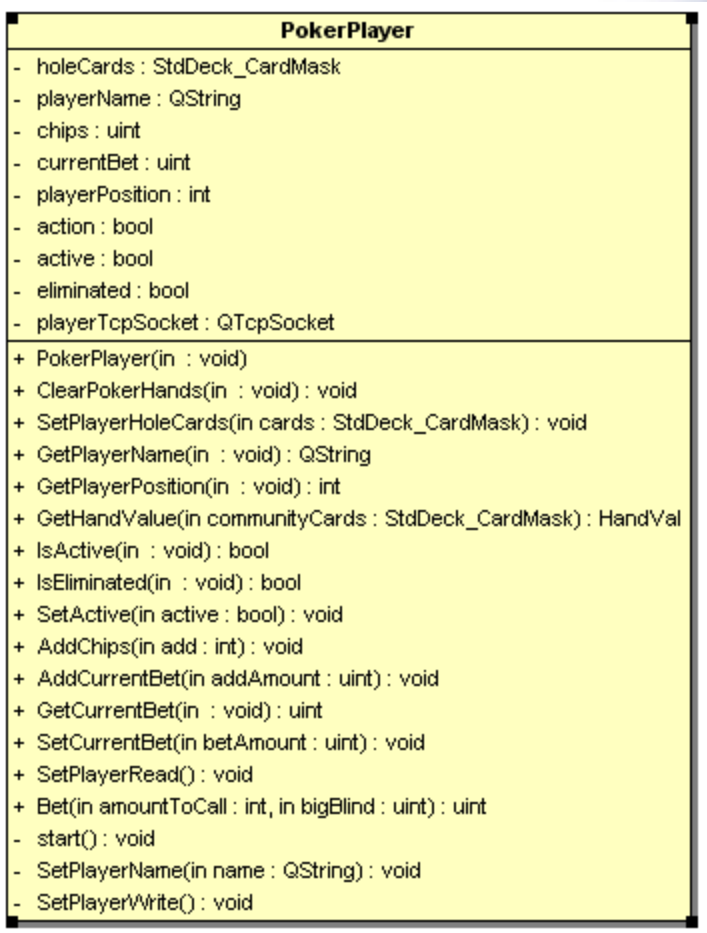
PokerExec Class(cont)

- State Machine
  - Used to control game state
  - Dependent on player actions
  - Runs per poker hand



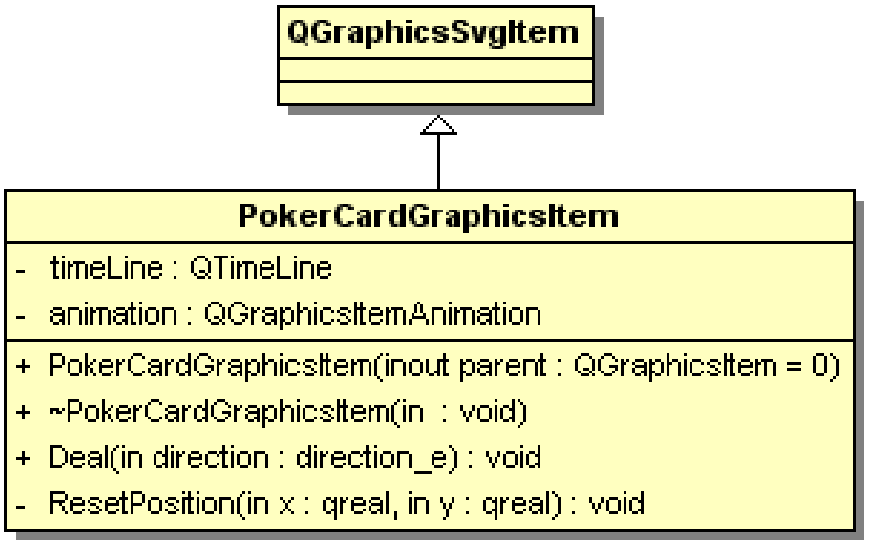
PokerPlayer Class

- Runs thread to receive data from iPhone interface
  - Only looks at proper time depending on game state
- Four objects are implemented in PokerExec as an array of PokerPlayers
  - Index(0 to 4) will be used to keep track of positions



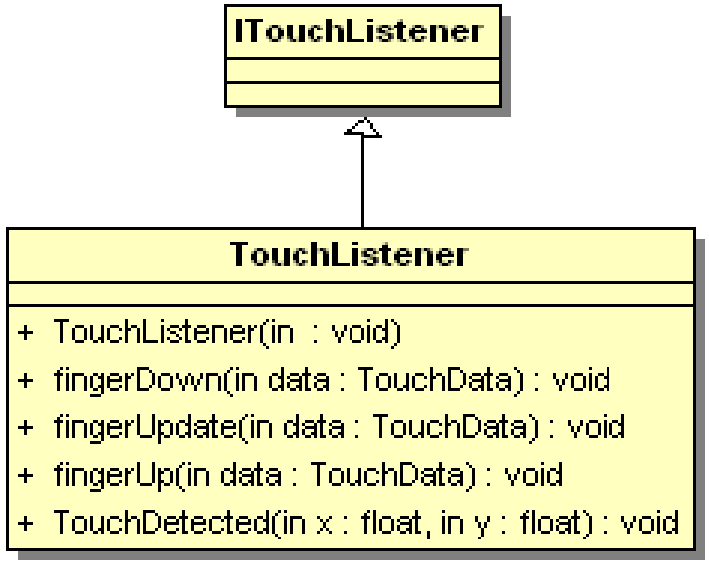
PokerCardGraphicsItem Class

- Originally planned to have card graphics as QGraphicsSvgItems(used on top of PokerSource types)
  - Particular can be called from the cards.svg file by passing a string(e.g. “queen_hearts”)
  - Needed a better way to implement animations
- Main purpose of class is to animate dealt cards
  - player hole cards, community cards



TouchListener Class

- Implements Touchlib to handle touch events
  - fingerDown,Update,Up are virtual functions of ITouchListener
  - TouchData will be passed to PokerExec class to handle user inputs
  - Location will be primary determination of what is to be done



Software Test Plan

- Each class will be unit tested
  - Ensures proper function at lowest level of software
  - Outputs for unit test will include .txt files or visual outputs that can be captured(example)

PokerExecTest.txt

- Integration testing
  - Occurs after each class has been unit tested
  - Pass/Fail criteria will be based on SRS

Software Progress

- ~50% complete
  - Game code is almost complete
  - Game graphics are currently being worked on
  - RestaurantMenu will continue once previous two are tested

Class	Design	Code	Unit Test
PokerExec	90%	85%	20%
PokerPlayer	95%	95%	20%
PokerCardGraphicsItem	100%	95%	50%
RestaurantMenu	100%	40%	0%
TouchListener	90%	30%	0%

Prototype Plan

Budget

Component	QUANTITY	PRICE	TOTAL PRICE
MULTI-TOUCH SCREEN			
DAP Silicone, 10.1fl oz.	1	$4.50	$4.50
Rosco Grey, 20”x24”	1	$6.50	$6.50
Acrylic Sheet, 24”x32”	1	$100.00	$100.00
LED			
IR LED, 880nm	80	$0.40	$32.00
INTAKE/EXHAUST FAN			
Yate Loon	2	$4.99	$9.98
IR CAMERA			
Playstation 3 Eye	1	$34.99	$34.99
POWER SUPPLY			
LED PS Parts	1	$5.00	$5.00
Temp Sensor Parts	1	$3.00	$3.00
USB Extension	2	$3.00	$6.00
Power Cord Extension	1	$10.00	$10.00
PROJECTOR			
Dell 1100MP	1	$150.00	$150.00
FRAMEWORK			
4x4	2	$5.50	$11.00
2x4	2	$2.41	$4.82
Wood Glue	1	$3.00	$3.00
MDF Sheet	1	$19.25	$19.25
Nails	1	$2.00	$2.00
Screws	1	$2.00	$2.00
Wheels	4	$2.00	$8.00
		TOTAL	**$412.04**

Milestone Chart

Remaining Schedule

- Finish constructing table by end of September
- Poker Game completed in next two weeks
- Complete TouchListener by mid-October
- Integration after TouchListener is complete
- Start testing first week of November

Questions?