# Adala

Final year project

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# What is Adala

Adala is a software project that facilitate law enforcement processes (Police and Investigation) to let them manage and monitor different police cases. It will have also a database of people, cars, addresses, and properties, and It will support work-flow such as open/foreword cases to be a special cases for investigation purposes, which will include work-flow actions such as approve and deny processes.

Police cases can be incident/accident reports, or arrest reports.

# Features

- Everything as an entry can be associated with anything else under a relation name (i.e. relate a person with suspicious car)
- Logging any changes on data
- Monitoring and reporting for police cases
- For new crime, giving suspect criminals
- Suggest names of youth in risk
- More

# Classify the Criminal/s

Artificial Neural Network will be implemented so the software will be able to classify criminal/s based on the cases' inputs and by utilizing previous data the software will provide suggested criminal/s' attributes that are based on the results coming from Artificial Neural Network (ANN) model.

# Crime Prevention

The software also should be able to apply crime prevention for youth at risk by collected and analyzing history data of a young person and the software will be able to classify that person if he/she has high probability of being a criminal in the future.

# Story Boards

Thanks for Julien Popa-Liesz

# Prototype of Case Management

Home

Create New Incident Report

Incident Report

Case Title: Man has been killed in downtown

Description:

A man found dead late Sunday at a downtown parking garage was apparently assaulted at another location several hours earlier.

The still-unidentified body of a man in his late 20s to early 30s was spotted shortly before 11 p.m. Sunday.

He was pronounced dead at the scene from what appeared to be blunt force trauma to the head.

HPD homicide detectives haven't identified any witnesses or suspects in the slaying. But surveillance video in the area is providing some clues.

The man is seen on video running near the garage about 4:50 a.m. Sunday. They believe he ran into the garage where he then collapsed and died.

The man was wearing a turquoise-colored polo shirt, gray plaid shorts and black tennis shoes.

Create

# Prototype of Case Management

## List of new incident reports

| Id | Incident Report | Control |
|---|---|---|
| 01 | Old incidenet report | Assign Investigation |
| 02 | Old incidenet report | Assign Investigation |
| 03 | Man has been killed in downtown | Assign Investigation |

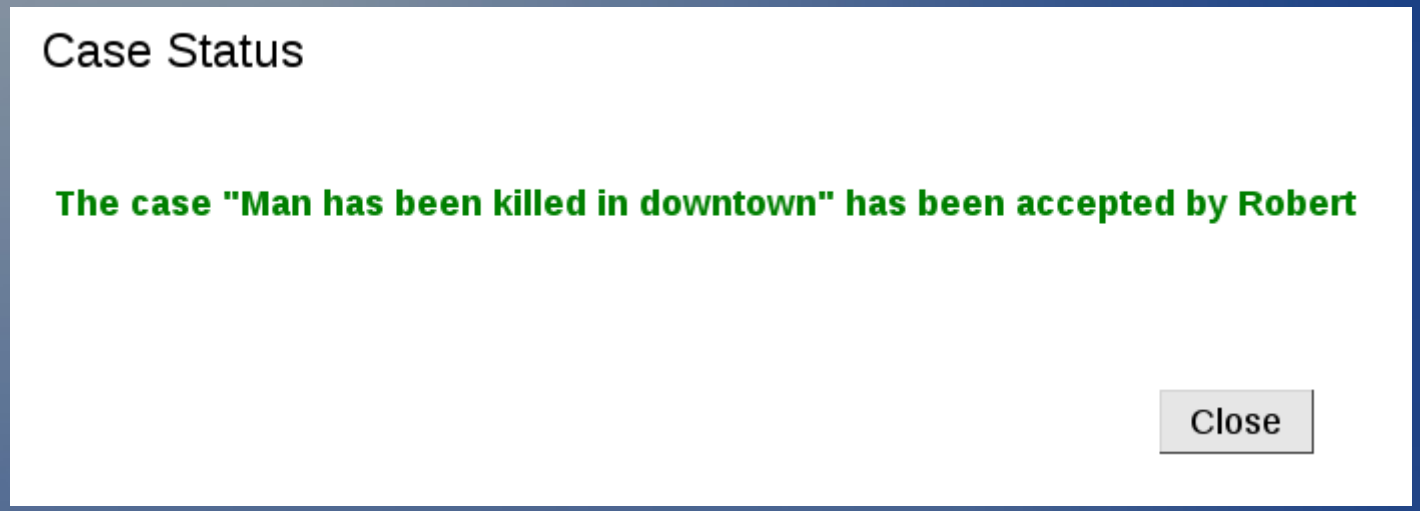
## Assign Investigators

| Id | Investigators | Control |
|---|---|---|
| 01 | Robert | Send Request |
| 02 | Tom | Send Request |
| 03 | Nick | Send Request |

## Investigator Page

| Id | Incident Report | Control | Control |
|---|---|---|---|
| 01 | Old incidenet report | Accept | Reject |
| 02 | Old incidenet report | Accept | Reject |
| 03 | Man has been killed in downtown | Accept | Reject |

# Prototype of Case Management



# Prototype of Case Management

Investigator Page

Create new Group

Group members

| Robert |
| --- |
| Tom |

Create Tasks

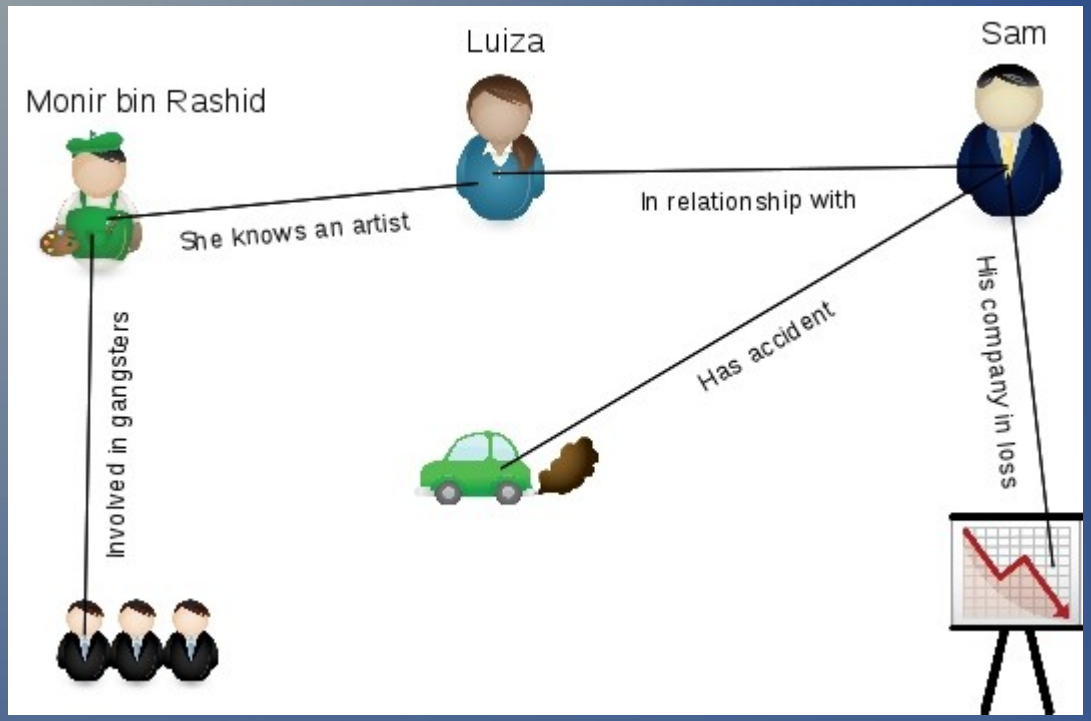
| Id | Tasks | Assigned to |
| --- | --- | --- |
| 01 | Collect DNA Samples | Tom |
| 02 | Do som interviews | Robert |
| 03 | Check city parking tickets | Robert |

Case Visualization

# Story Boards

Thanks for Julien Popa-Liesz

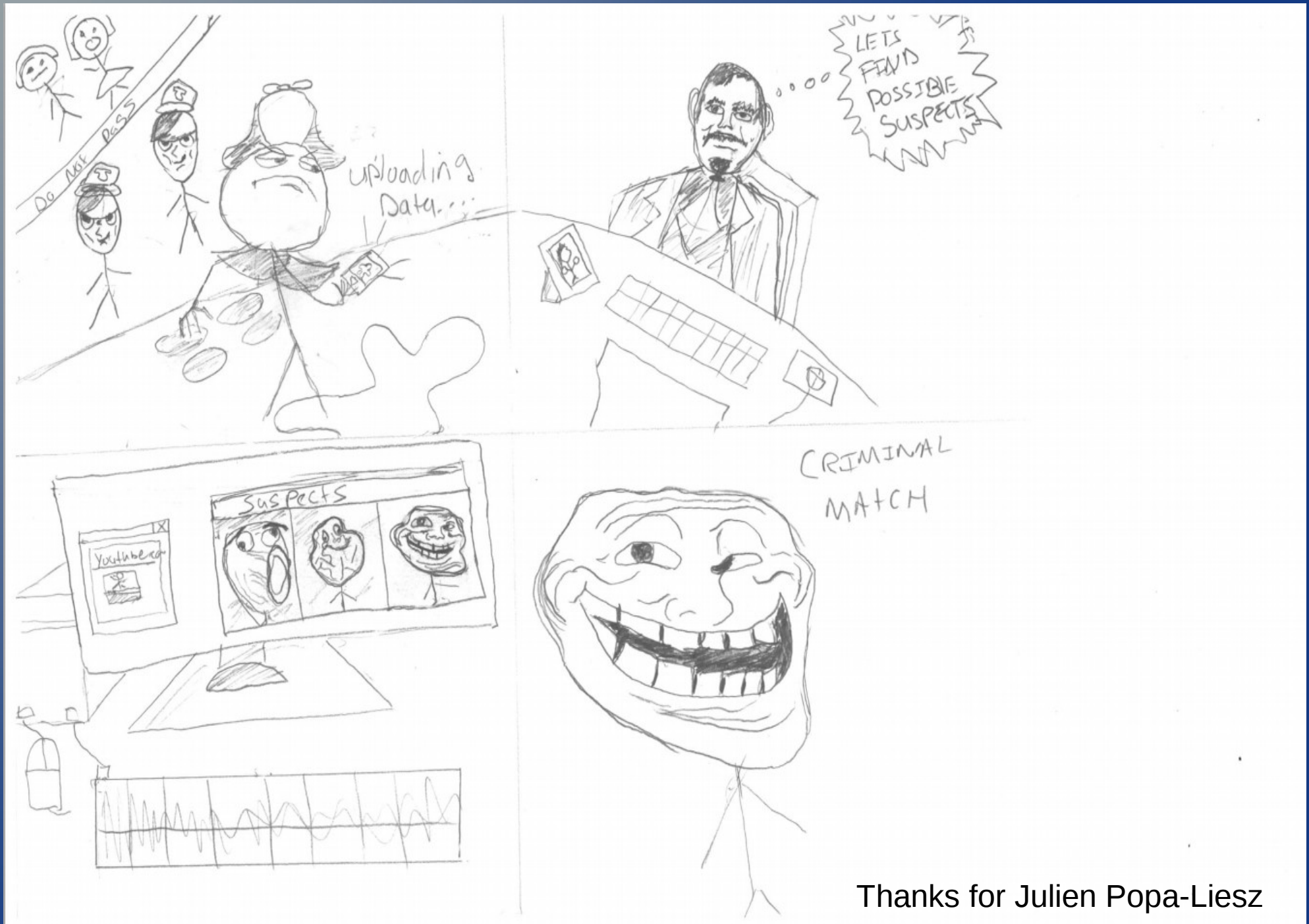
# Prototype of Case Management




## Suspect Persons

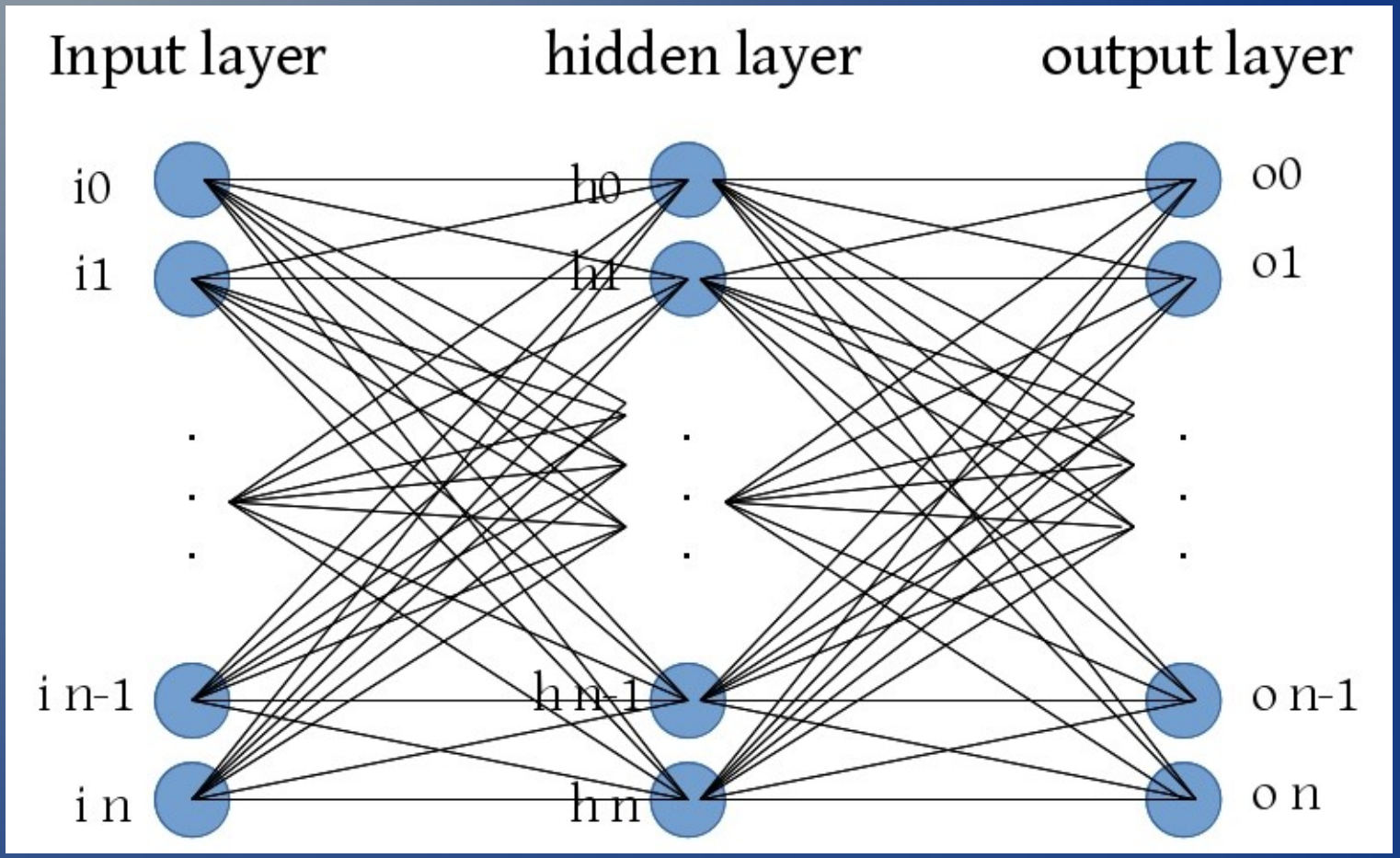
| Id | Name | Probability | View Profile |
|---|---|---|---|
| 01 | Rich North | 91% | View |
| 02 | Sam Lime | 77% | View |
| 03 | Jastain Walton | 53% | View |

# Story Boards




Thanks for Julien Popa-Liesz

# ANN model


Input layer
hidden layer
output layer
i0
i1
i n-1
i n
h0
h1
h n-1
h n
o0
o1
o n-1
o n

# Sigmoid Function

Sigmoid Function

using $\sigma(\beta, t) = \frac{1}{1 + e^{-\beta t}}$,

For feeding forward

The Derivative of Sigmoid Function

$$\frac{d\sigma(t)}{dt} = \sigma(t)[1 - \sigma(t)]$$

For Back propagation

http://en.wikibooks.org/wiki/Artificial_Neural_Networks/Activation_Functions

# Sigmoid Function

- Feed Forward implementation

```
void feedForward {
        net = threshold
        for (inputEdge : inputEdges) {
                net += inputEdge.LeftNeuron.output * inputEdge.Weight
        }
        output = Neuron.sigmoid(net)
}
double sigmoid(double net) {
        return 1  /  (1 + Math.exp(-net))
}
```

# Sigmoid Function

- Back Probagate For Output Layer

```
void backPropagate(...) {

for (int i = 0; i < this.numberOfNeurons; i++) {

    n = neurons[i]

    // update error

    n.setError(derivativeOfSigmoid(expectedOutputs[i], n.Output))

    // update delta threshold

    n.updateThreshold(learningRate, momentum)

    // update input edges weights

    for (Edge e : n.InputEdges)

        e.updateWeight(learningRate, momentum)

    }

}
```

# Sigmoid Function

- Devivative of Sigmoid implementation

```
double derivativeOfSigmoid(double expectedOutput, double output) {
    return (expectedOutput - output) * output * (1 - output)
}
```

- Updating the threshold implementation

```
void updateThreshold(double learningRate, double momentum) {
    // update delta threshold
    deltaThreshold = learningRate * Error + momentum * PrevDeltaThreshold
    // update threshold
    threshold += deltaThreshold
}
```

# Sigmoid Function

- Updating Weights implementation

```
updateWeight(learningRate lr, momentum m) {
        // update delta weight
        DeltaWeight = lr * rightNeuron.Error * leftNeuron.Output + (m * PrevDeltaWeight)
        // update weight
        weight += DeltaWeight
}
```

# Crime Scene Attributes

- foreignObjectPenetration
- faceNotDeliberatelyHidden
- victimWasBlindfolded
- woundsCausedByBluntInstrument
- Suffocation
- vaginalPenetration
- analPenetration
- faceUp
- victimPartiallyUndressed
- victimNaked
- deliberateClothingDamaged
- bound
- stabbingInjuries
- manualInjuries
- gunshotWounds
- woundsToTheHead
- WoundsToTheFace
- woundsToTheNeck
- woundsToTheTorso
- woundsToTheLimbs
- multipleWoundsToOneBodyArea
- multipleWoundsDistributedAcross DifferentBodyParts
- weaponBroughtToScene
- weaponFromTheScene
- identifiablePropertyStolen
- nonidentifiablePropertyStolen
- valuablePropertyStolen
- bodyHidden // (outside)
- bodyTransported
- offenderForensicallyAware
- VictimFoundAtTheSameScene WhereTheyWereKilled
- sexualCrime
- arsonToCrimeSceneOrBody
- victimFoundInWater
- victimDruggedAndOrPoisoned
- victimCovered

36 total

# Offender Profile Attributes

- youngOffenderBetween17And21Years
- criminalRecordOfTheft
- criminalRecordOfFraud
- criminalRecordOfBurglary
- relationshipWithVictim
- unemployedAtTheTimeOfOffense
- male
- familiarWithAreaOfOffenseOccurrence
- criminalRecordOfViolence
- criminalRecordOfCommittingDamage
- criminalRecordOfDisorderlyConduct
- recordOfImprisonment
- sexualRelatedCriminalRecord
- armedServices_PastOrPresent
- knewVictim
- historyOfAbusivenessInPastRelationships
- attemptsOfSuicide
- psychiatricDisorders
- relatedToVictim
- bloodRelativeToVictim
- turnedSelfIntoPolice

21 total

# Creating Fake data

- Based on the results in “Bayesian Network Modeling of Offender Behavior for Criminal Profiling” paper
- Abstract —A Bayesian network (BN) model of criminal behavior is obtained linking the action of an offender on the scene of the crime to his or her psychological profile. Structural and parameter learning algorithms are employed to discover inherent relationships that are embedded in a database containing crime scene and offender characteristics  from homicide cases solved by the British police from the 1970s to the early 1990s

# Creating Fake data

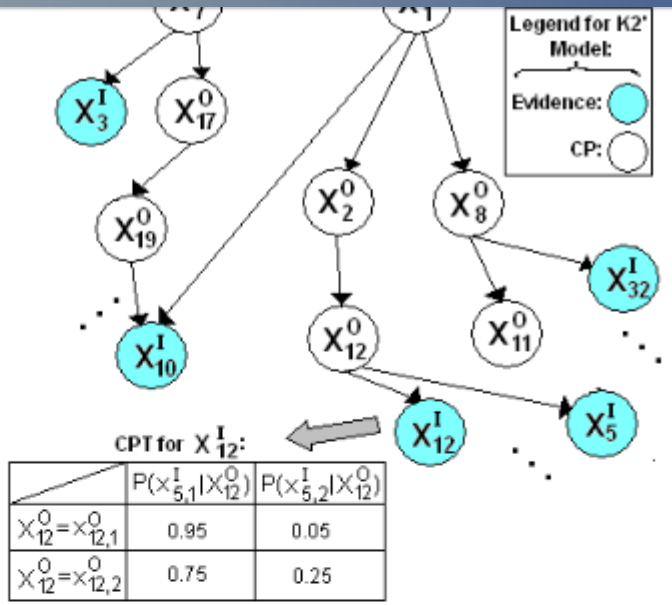



Fig. 3. A slice from the actual full BN structure that is learned from data by the K2′ algorithm (CPTs are not shown for simplicity).

relations among the input variables. The modified K2′ algorithm is faster, more effective, and requires fewer number of training cases for learning a BN from data for the purpose of predicting a criminal profile. This paper shows that additional conditional independence relationships can be effectively incorporated into the learning procedure to increase the final model performance. Inhibiting nodal connections systematically decreases the search space and is shown to improve the model performance considerably. Most importantly, the K2′ requires a smaller sample of training cases than the K2 algorithm, which may otherwise lead to ZMP predications. This attribute is particularly useful in applications where

TABLE III

DEFINITION OF THE CRIME SCENE VARIABLES.

| Variable | Definition |
|---|---|
| $X^I_1$: | Vaginal penetration |
| $X^I_2$: | Anal penetration |
| $X^I_3$: | Foreign object penetration |
| $X^I_4$: | Victim found face up |
| $X^I_5$: | Victim's face not deliberately hidden |
| $X^I_6$: | Victim partially undressed |
| $X^I_7$: | Victim naked |
| $X^I_8$: | Clothing damage |
| $X^I_9$: | Bound (at one point) |
| $X^I_{10}$: | Blindfolded (at one point) |
| $X^I_{11}$: | Stabbed |
| $X^I_{12}$: | Blunt instrument |
| $X^I_{13}$: | Manual method (e.g. strangulation) |
| $X^I_{14}$: | Shot |
| $X^I_{15}$: | Wounds to head |
| $X^I_{16}$: | Wounds to face |
| $X^I_{17}$: | Wounds to neck |
| $X^I_{18}$: | Wounds to torso |
| $X^I_{19}$: | Wounds to limbs |
| $X^I_{20}$: | Multiple wounds to one area of body |

# Creating Fake data

| Variable | Definition | Arcs (children) |
|---|---|---|
| $X_1^O$: | Prior theft | $X_2^O$, $X_8^O$, $X_{21}^O$, $X_{10}^I$, $X_{24}^I$, $X_{25}^I$ |
| $X_2^O$: | Prior burglary | $X_3^O$, $X_4^O$, $X_6^O$, $X_9^O$, $X_{12}^O$, $X_{26}^I$ |
| $X_3^O$: | Prior violence | $X_4^O$, $X_8^I$, $X_{12}^I$ |
| $X_4^O$: | Prior damage | $X_5^O$, $X_{20}^O$ |
| $X_5^O$: | Prior disorder | – |
| $X_6^O$: | Prison | $X_9^O$, $X_{12}^O$, $X_3^I$ |
| $X_7^O$: | Young offender between 17-21 years | $X_{10}^O$, $X_{17}^O$, $X_2^I$, $X_3^I$, $X_9^I$ |
| $X_8^O$: | Unemployed at the time of offense | $X_{11}^O$, $X_{14}^I$, $X_{32}^I$ |
| $X_9^O$: | History of sex crime | $X_{13}^O$ |
| $X_{10}^O$: | Armed service | – |
| $X_{11}^O$: | Familiar with area of offense occurrence | – |
| $X_{12}^O$: | Male | $X_5^I$, $X_{12}^I$, $X_{31}^I$, $X_{35}^I$, $X_{36}^I$ |
| $X_{13}^O$: | Knew victim | $X_{15}^O$, $X_{19}^O$, $X_{20}^O$, $X_{27}^I$, $X_{28}^I$, $X_{30}^I$ |
| $X_{14}^O$: | History of abuse | disonnected |
| $X_{15}^O$: | Suicide (attempted after crime) | $X_{16}^O$, $X_{21}^I$ |
| $X_{16}^O$: | Psychiatric or social problems | $X_{28}^I$, $X_{34}^I$ |
| $X_{17}^O$: | Prior fraud | $X_{19}^O$, $X_{14}^I$, $X_{33}^I$ |
| $X_{18}^O$: | Related to victim | $X_6^I$, $X_{11}^I$, $X_{19}^I$, $X_{21}^I$, $X_{24}^I$ |
| $X_{19}^O$: | Relationship with victim | $X_{20}^O$, $X_{10}^I$, $X_{35}^O$ |
| $X_{20}^O$: | Blood related to victim | $X_{32}^I$ |
| $X_{21}^O$: | Turned themselves in | $X_1^I$, $X_4^I$, $X_6^I$, $X_{24}^I$, $X_{29}^I$, $X_{31}^I$, $X_{33}^I$ |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*Learning in Graphical Models*, M. Jordan, Ed., 1998

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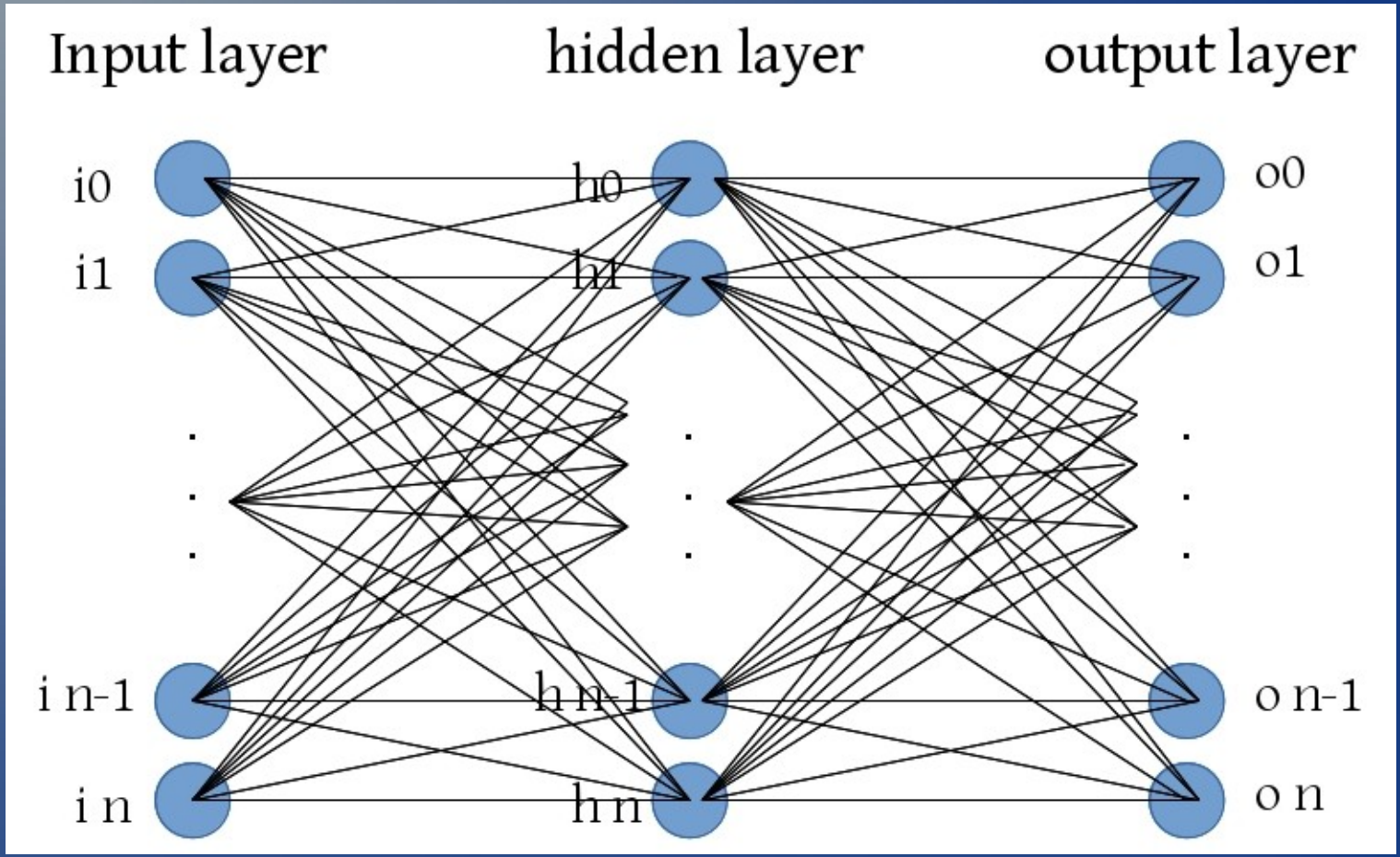
http://www.ai.mit.edu/ murphyk/Software/BNT/bnt.ht

# Creating Fake data

- Picked random number from 1 to 21 to pick on offender profile attribute
- Based on the archs make all children to true (either offender profile or crime scene attributes)
- Save offender profile and crime scene entities in the database with relationship one to one

# ANN model
# for Crime Scene and Offender Profile




n = 36

n = 24

n = 21

Learning rate = 0.52
momentum = 0.15

# of Passes = 50,000

# Youth in Risk Attributes

## Individual factors

- pregnancyAndDeliveryComplications
- lowRestingHeartRate
- internalizingDisorders
- hyperactivityConcentrationProblems_Restlessness_RiskTaking
- aggressiveness
- earlyInitiationOfViolentBehavior
- involvementInOtherFormsOfAntisocialBehavior
- beliefs_AttitudesFavorableToDeviantOrAntisocialBehavior

## Family factors

- parentalCriminality
- childMaltreatment
- poorFamilyManagementPractices
- lowLevelsOfParentalInvolvement
- poorFamilyBondingAndFamilyConflict
- parentalAttitudesFavorableToSubstanceUseAndViolence
- parentchildSeparation

## School factors

- academicFailure
- lowBondingToSchool
- truancyAndDroppingOutOfSchool
- frequentSchoolTransitions

## Peer-related factors

- delinquentSiblings
- delinquentPeers
- gangMembership

27 total

## Peer-related factors

- poverty
- communityDisorganization
- availabilityOfDrugsAndFirearms
- neighborhoodAdultsInvolvedInCrime
- exposureToViolenceAndRacialPrejudice

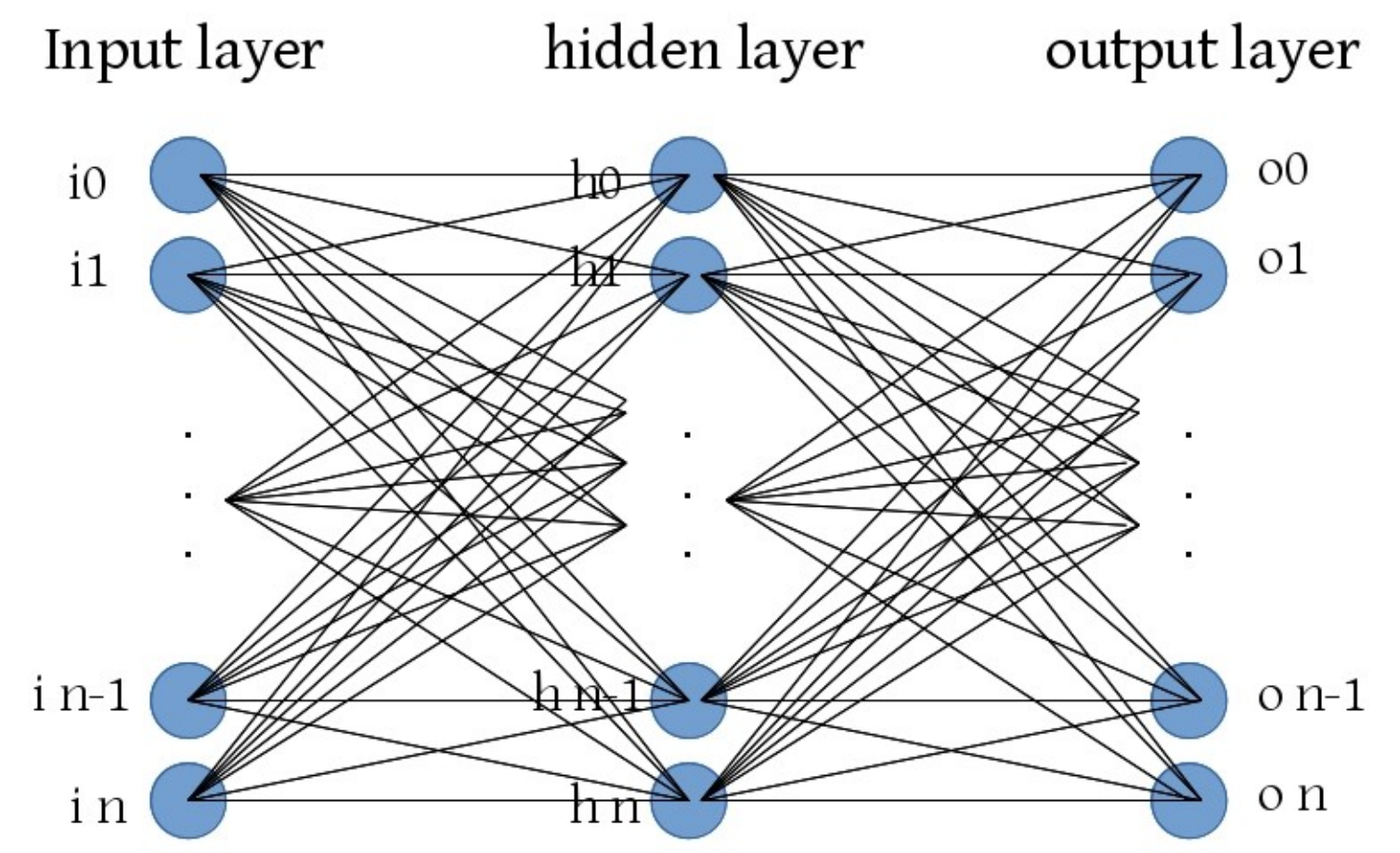
http://www.crim.cam.ac.uk/people/academic_research/david_farrington/predviol.pdf

# Crime Types

- Murder
- Theft
- Fraud
- Burglary
- Violence
- Committing Damage
- Disorderly Conduct

7 total

# ANN model for Youth in Risk




n = 27

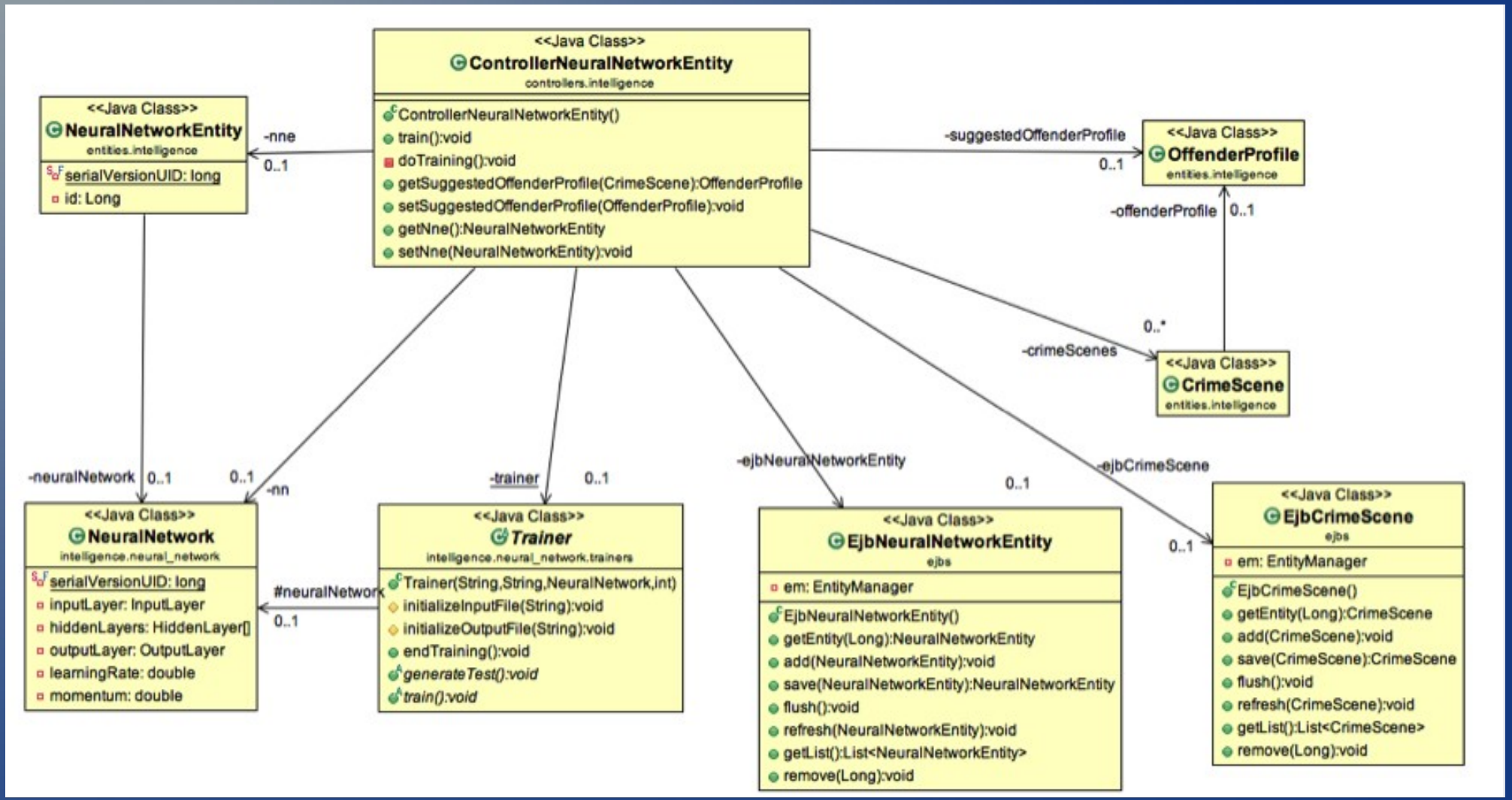
n = 18

n = 7

Learning rate = 0.52
momentum = 0.15

# of Passes = 50,000

# ANN UML


<<Java Class>>
ControllerNeuralNetworkEntity
controllers.intelligence
ControllerNeuralNetworkEntity()
train():void
doTraining():void
getSuggestedOffenderProfile(CrimeScene):OffenderProfile
setSuggestedOffenderProfile(OffenderProfile):void
getNne():NeuralNetworkEntity
setNne(NeuralNetworkEntity):void
<<Java Class>>
NeuralNetworkEntity
entities.intelligence
serialVersionUID: long
id: Long
-nne
0..1
-suggestedOffenderProfile
0..1
<<Java Class>>
OffenderProfile
entities.intelligence
-offenderProfile
0..1
0..*
-crimeScenes
<<Java Class>>
CrimeScene
entities.intelligence
-neuralNetwork
0..1
0..1
-nn
-trainer
0..1
-ejbNeuralNetworkEntity
0..1
-ejbCrimeScene
0..1
<<Java Class>>
NeuralNetwork
intelligence.neural_network
serialVersionUID: long
inputLayer: InputLayer
hiddenLayers: HiddenLayer[]
outputLayer: OutputLayer
learningRate: double
momentum: double
#neuralNetwork
0..1
<<Java Class>>
Trainer
intelligence.neural_network.trainers
Trainer(String,String,NeuralNetwork,int)
initializeInputFile(String):void
initializeOutputFile(String):void
endTraining():void
generateTest():void
train():void
<<Java Class>>
EjbNeuralNetworkEntity
ejbs
em: EntityManager
EjbNeuralNetworkEntity()
getEntity(Long):NeuralNetworkEntity
add(NeuralNetworkEntity):void
save(NeuralNetworkEntity):NeuralNetworkEntity
flush():void
refresh(NeuralNetworkEntity):void
getList():List<NeuralNetworkEntity>
remove(Long):void
<<Java Class>>
EjbCrimeScene
ejbs
em: EntityManager
EjbCrimeScene()
getEntity(Long):CrimeScene
add(CrimeScene):void
save(CrimeScene):CrimeScene
flush():void
refresh(CrimeScene):void
getList():List<CrimeScene>
remove(Long):void

# Thanks for

- Anthony J. Papagelis & Dong Soo Kim
- http://www.cse.unsw.edu.au/~cs9417ml/MLP2/

# Development Info

- Scrum (incremental agile software development. on targateprocess.com)
- Git repository (on bitbucket.org)
- J2EE (JSF + Primefaces)
- Bootstrap & jQuery for interactive UI
- Glassfish as webserver
- EclipseLink for JPA
- Mysql (database)
- AWS -> EC2 -> CentOS (Host)
- Eclipse IDE

# Statistics

- User Stories
  - Must Have: 22 (**20** are  done)
  - Great:13 (**2** are done)
  - Good: 6 (**0** done)
  - Average: 1 (**0** done)
  - Nice To Have: 4 (**0** is done)
- The time effort done from 12Aug2014 till Now is **186** hours
- 20,951 lines of *.java files
- 8,497 lines of *.xhtml files
- 2,202 lines of *.xml files
- **Total: 31,650** Lines of Code (not Auto Generated code)

# Milestones

| ID | Name | Project | Start Date | End Date | Sprints | Effort | Progress | Tags |
|---|---|---|---|---|---|---|---|---|
| 433 | Release #3 | FIN | 01-Jan-2015 | 14-Mar-2015 | 6 | 240 h | 0% | |

| Name | Velocity | Start Date | End Date | Effort | Progress |
|---|---|---|---|---|---|
| Sprint#3.1 | 0 h | 03-Jan-2015 | 16-Jan-2015 | 240 h | 0% |
| Sprint#3.2 | 0 h | 17-Jan-2015 | 30-Jan-2015 | 0 h | 0% |
| Sprint#3.3 | 0 h | 31-Jan-2015 | 13-Feb-2015 | 0 h | 0% |
| Sprint#3.4 | 0 h | 14-Feb-2015 | 27-Feb-2015 | 0 h | 0% |
| Sprint#3.5 | 0 h | 28-Feb-2015 | 13-Mar-2015 | 0 h | 0% |
| Sprint#3.6 | 0 h | 14-Mar-2015 | 24-Mar-2015 | 0 h | 0% |

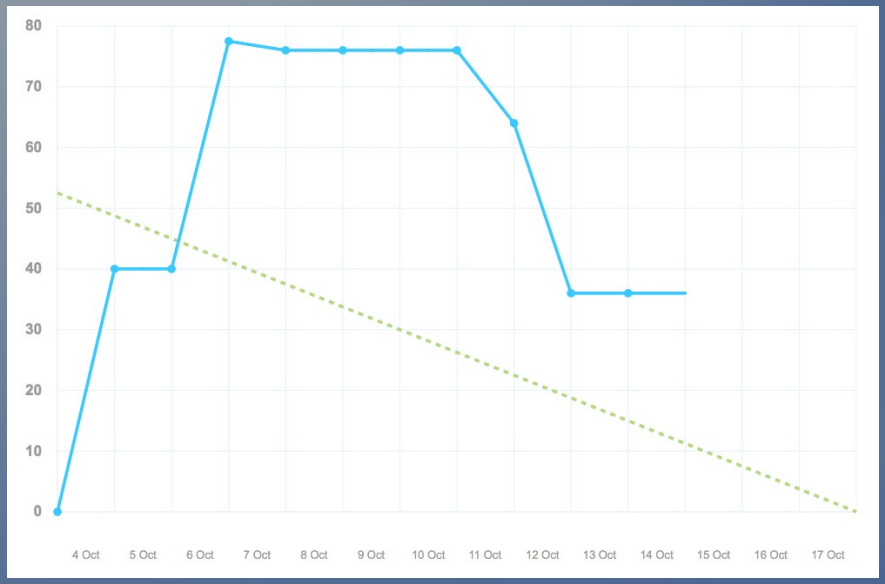
| ID | Name | Project | Start Date | End Date | Sprints | Effort | Progress | Tags |
|---|---|---|---|---|---|---|---|---|
| 415 | Release #2 (current) | FIN | 01-Oct-2014 | 31-Dec-2014 | 7 | 273 h | ~16% | |

| Name | Velocity | Start Date | End Date | Effort | Progress |
|---|---|---|---|---|---|
| Sprint #2.1 (current) | 0 h | 04-Oct-2014 | 17-Oct-2014 | 80 h | ~55% |
| Sprint#2.2 | 0 h | 18-Oct-2014 | 31-Oct-2014 | 0 h | 0% |
| Sprint#2.3 | 0 h | 01-Nov-2014 | 14-Nov-2014 | 5 h | 0% |
| Sprint#2.4 | 0 h | 15-Nov-2014 | 28-Nov-2014 | 60 h | 0% |
| Sprint#2.5 | 0 h | 29-Nov-2014 | 12-Dec-2014 | 24 h | 0% |
| Sprint#2.6 | 0 h | 13-Dec-2014 | 26-Dec-2014 | 89 h | 0% |
| Sprint#2.7 | 0 h | 27-Dec-2014 | 31-Dec-2014 | 15 h | 0% |

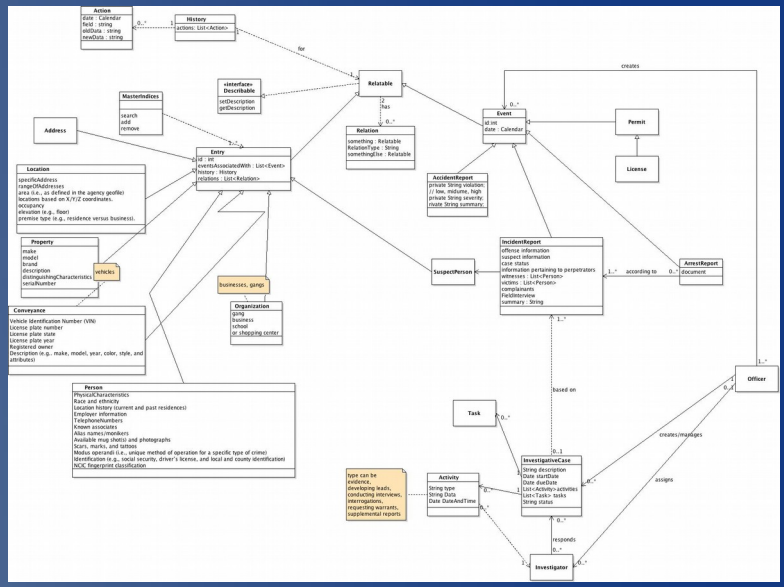
| ID | Name | Project | Start Date | End Date | Sprints | Effort | Progress | Tags |
|---|---|---|---|---|---|---|---|---|
| 403 | Release #1 | FIN | 12-Aug-2014 | 31-Aug-2014 | 2 | 41 h | 100% | |

| Name | Velocity | Start Date | End Date | Effort | Progress |
|---|---|---|---|---|---|
| Sprint #1.1 | 0.8 h | 12-Aug-2014 | 21-Aug-2014 | 29 h | 100% |
| Sprint #1.2 | 0 h | 22-Aug-2014 | 31-Aug-2014 | 12 h | 100% |

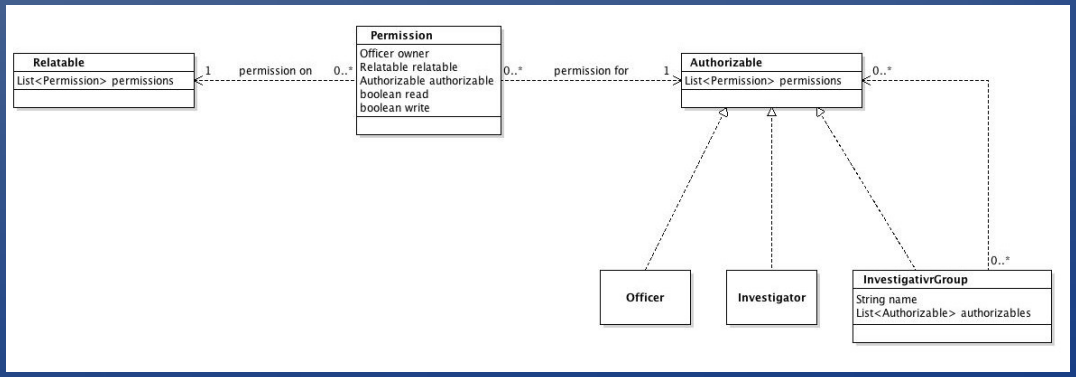
# Screen Shoots




Sprint#2.1 Burn Down

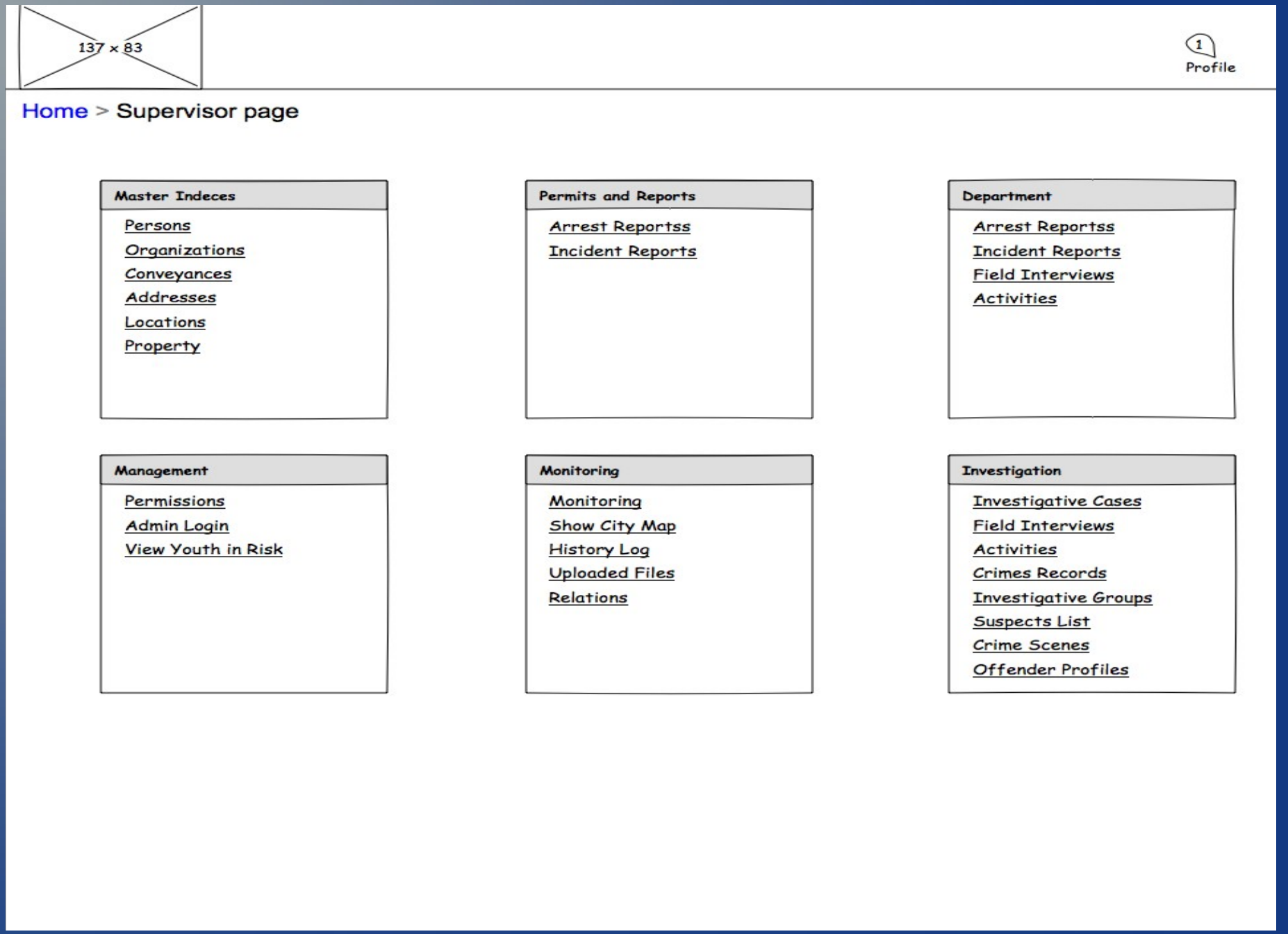


Core functionality UML



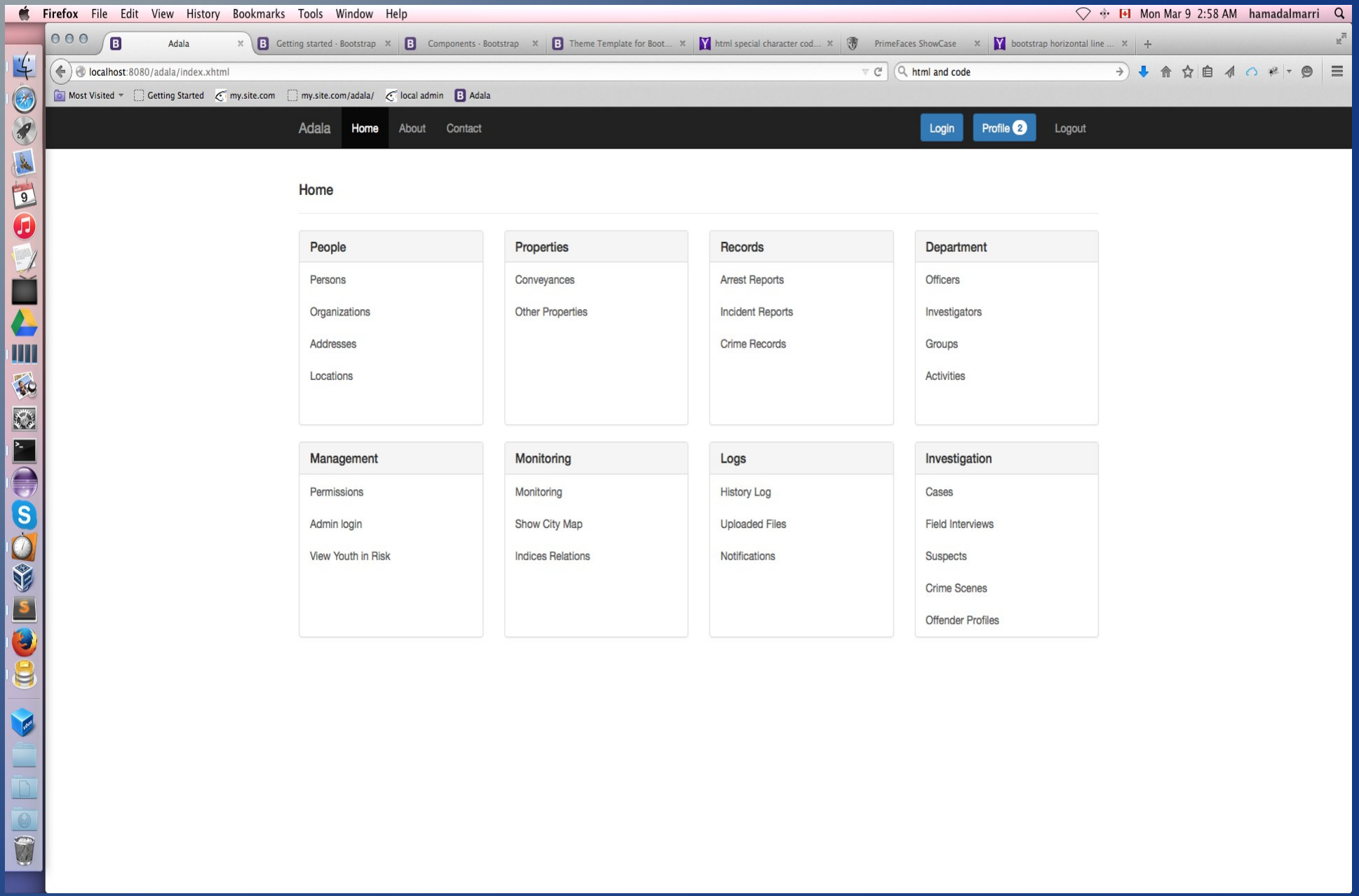

UML for permissions

# Screen Shoots



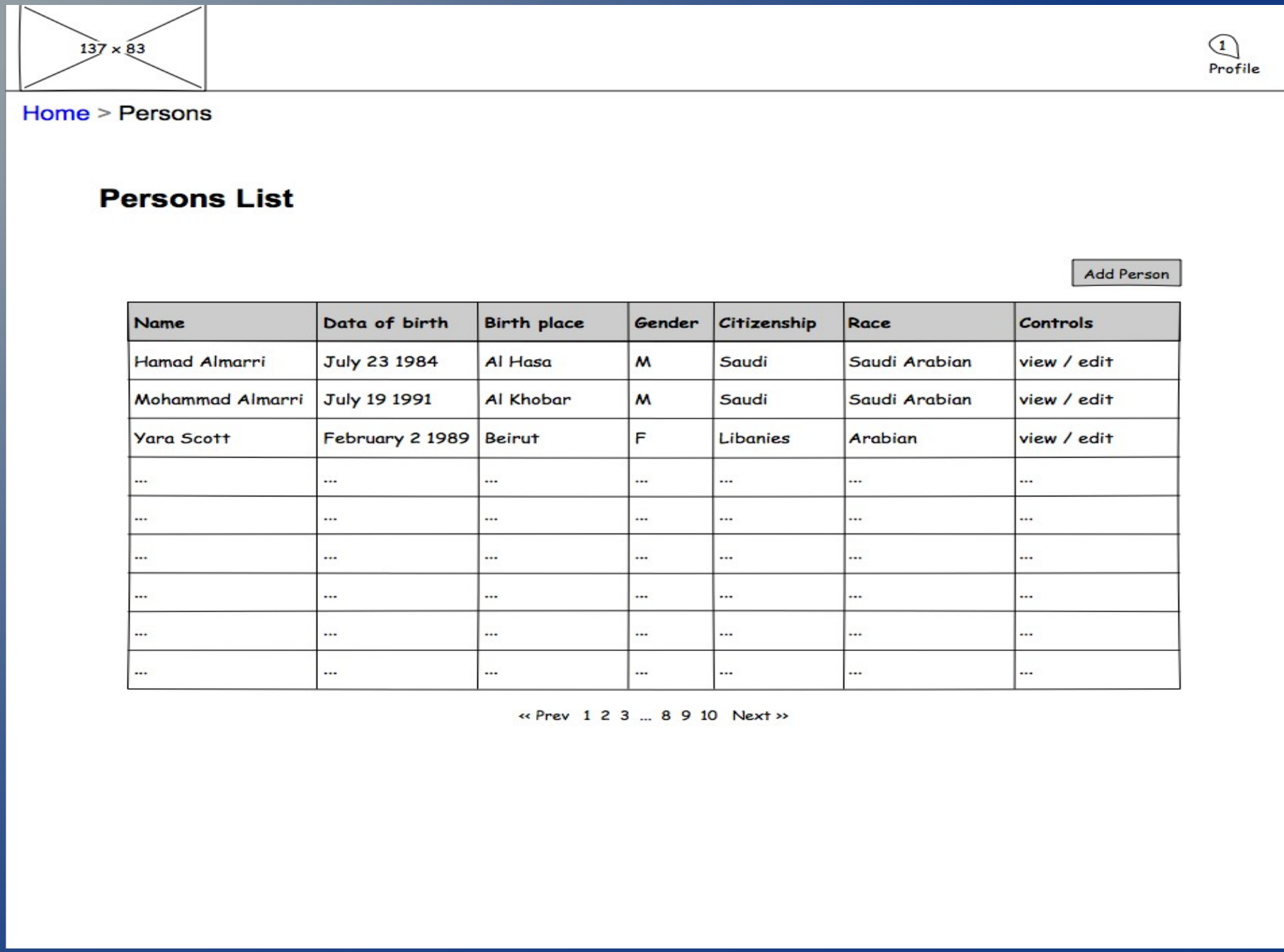

Wireframe of home page

# Screen Shoots



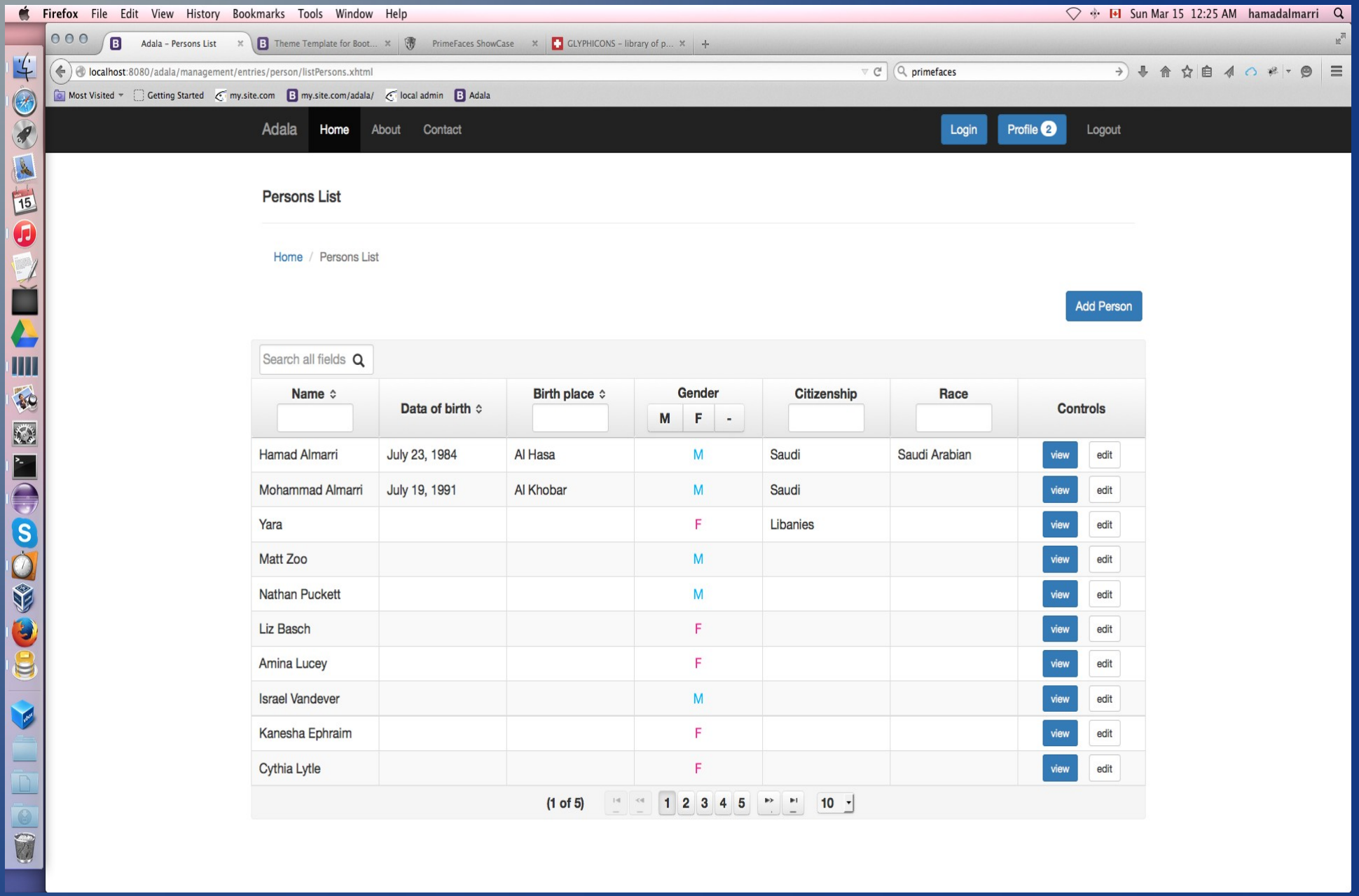

home page

# Screen Shoots



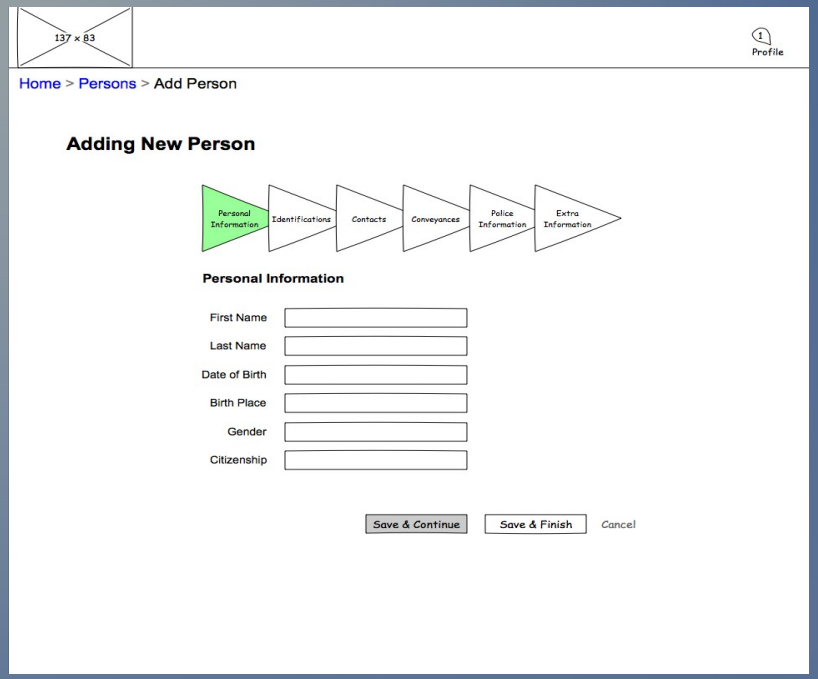

Wireframe of persons list page

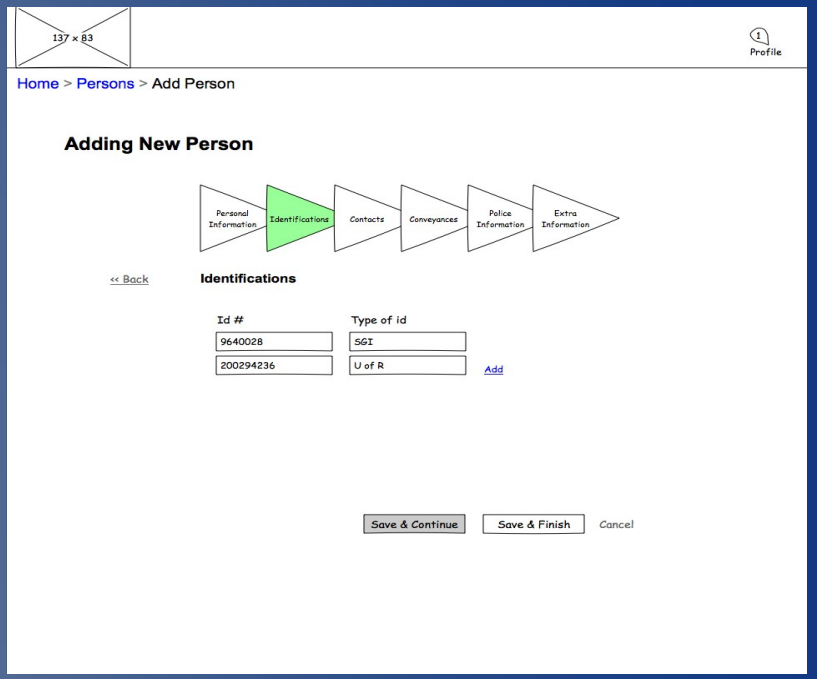
# Screen Shoots

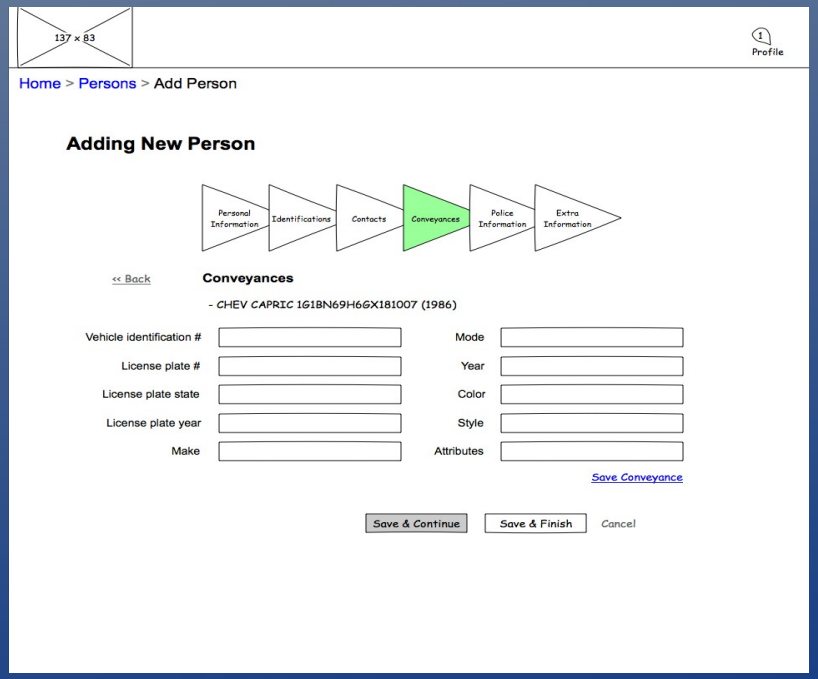


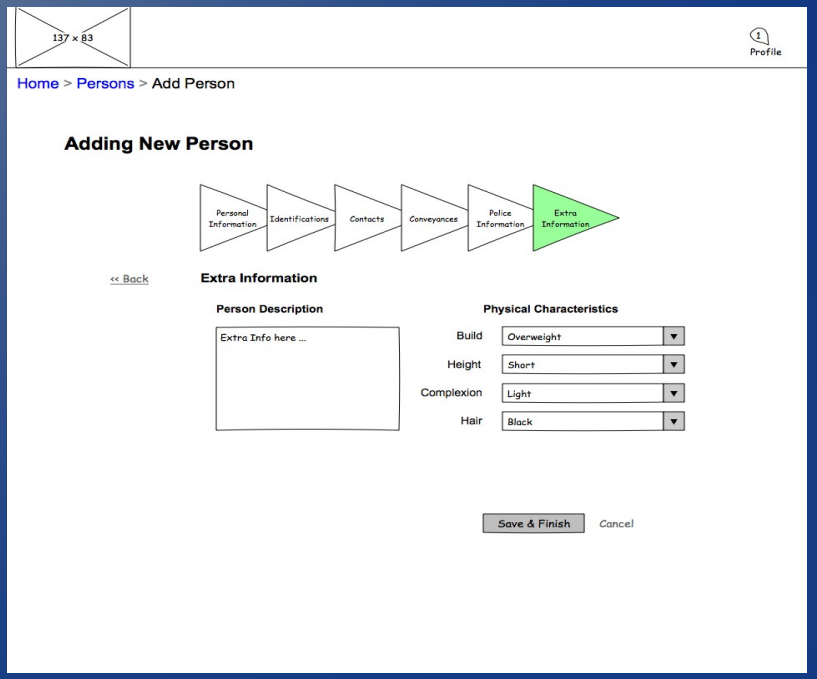

Persons list page

# Screen Shoots



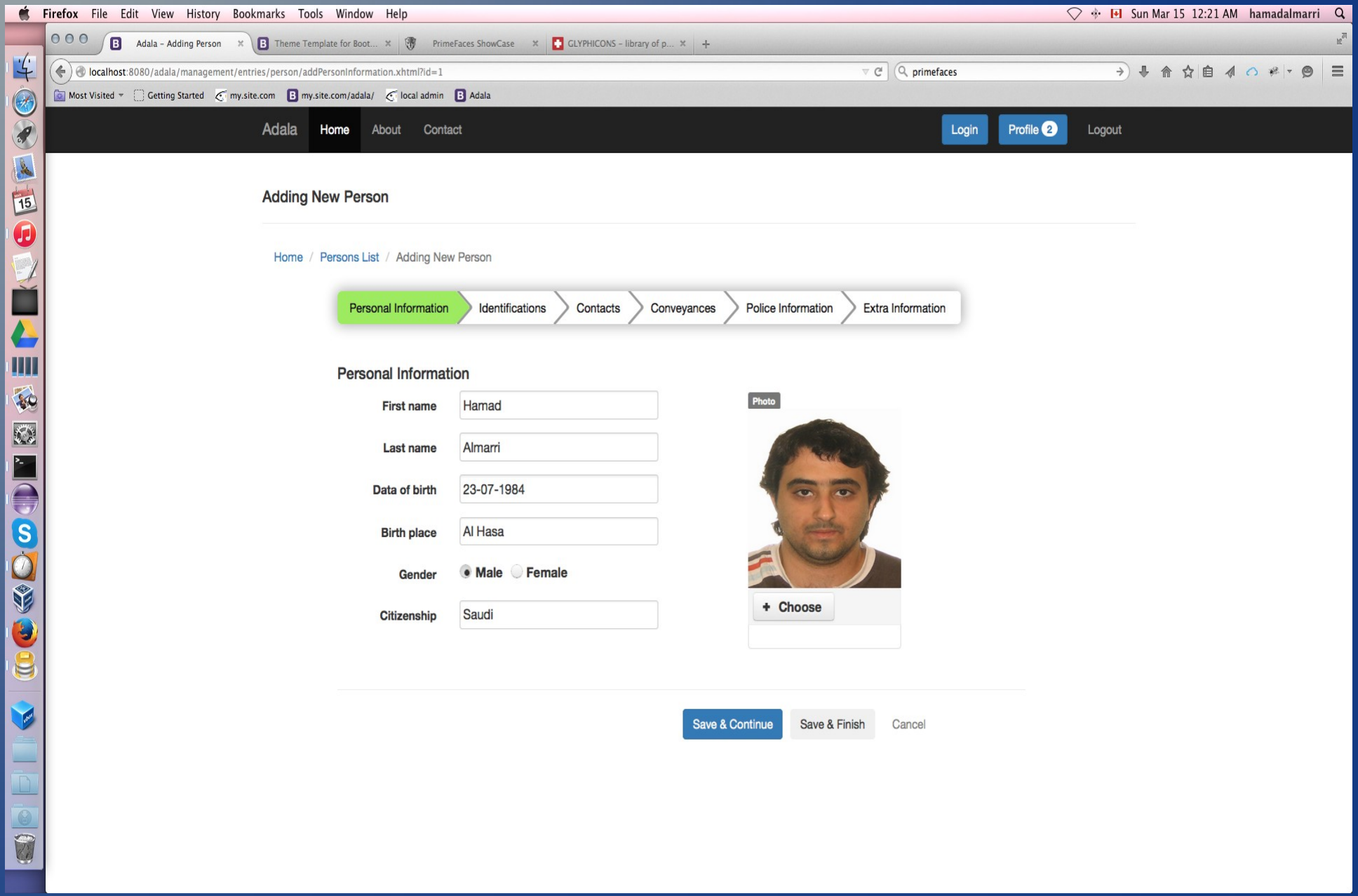



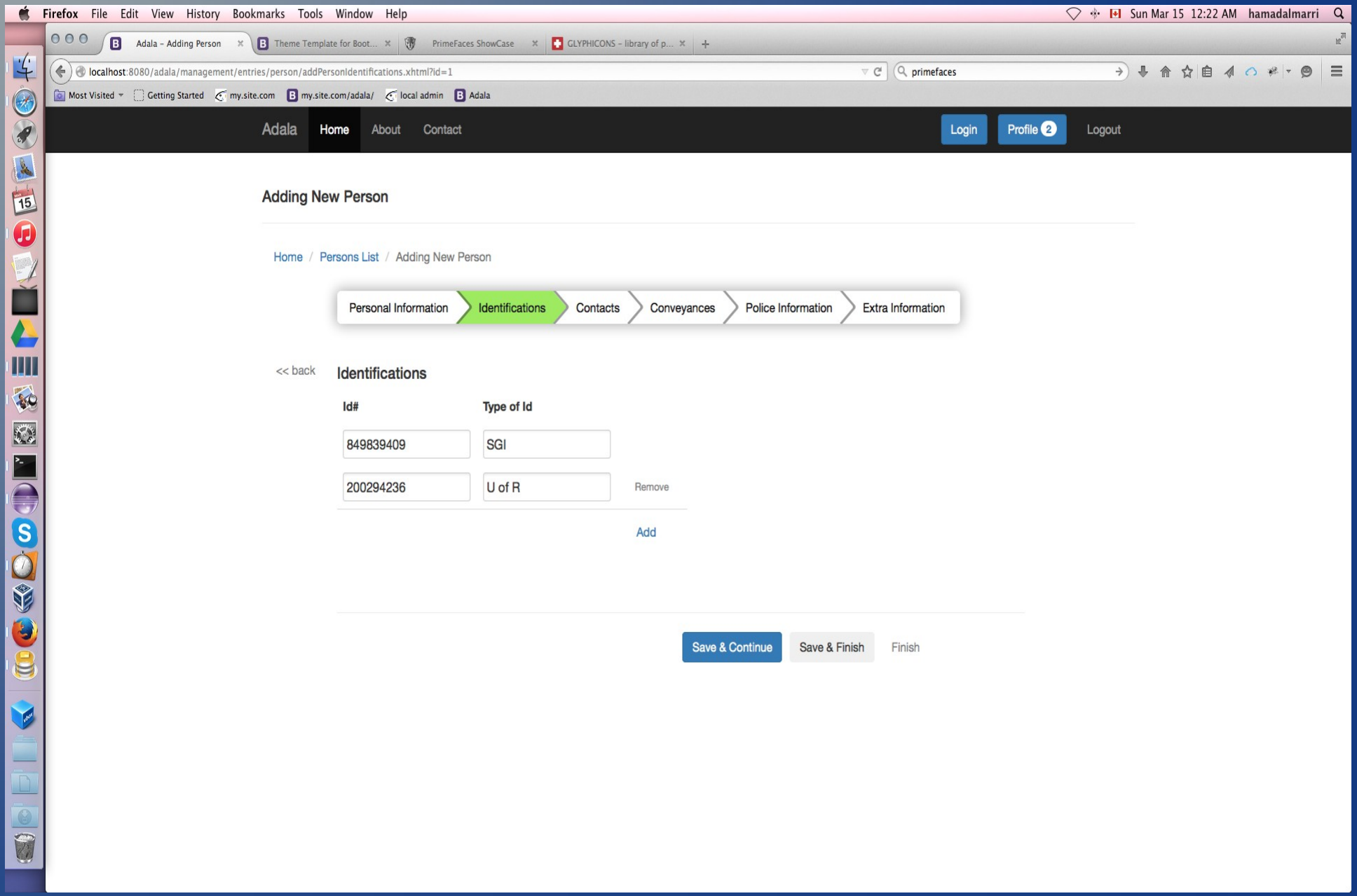

Wireframes for adding new person

# Screen Shoots



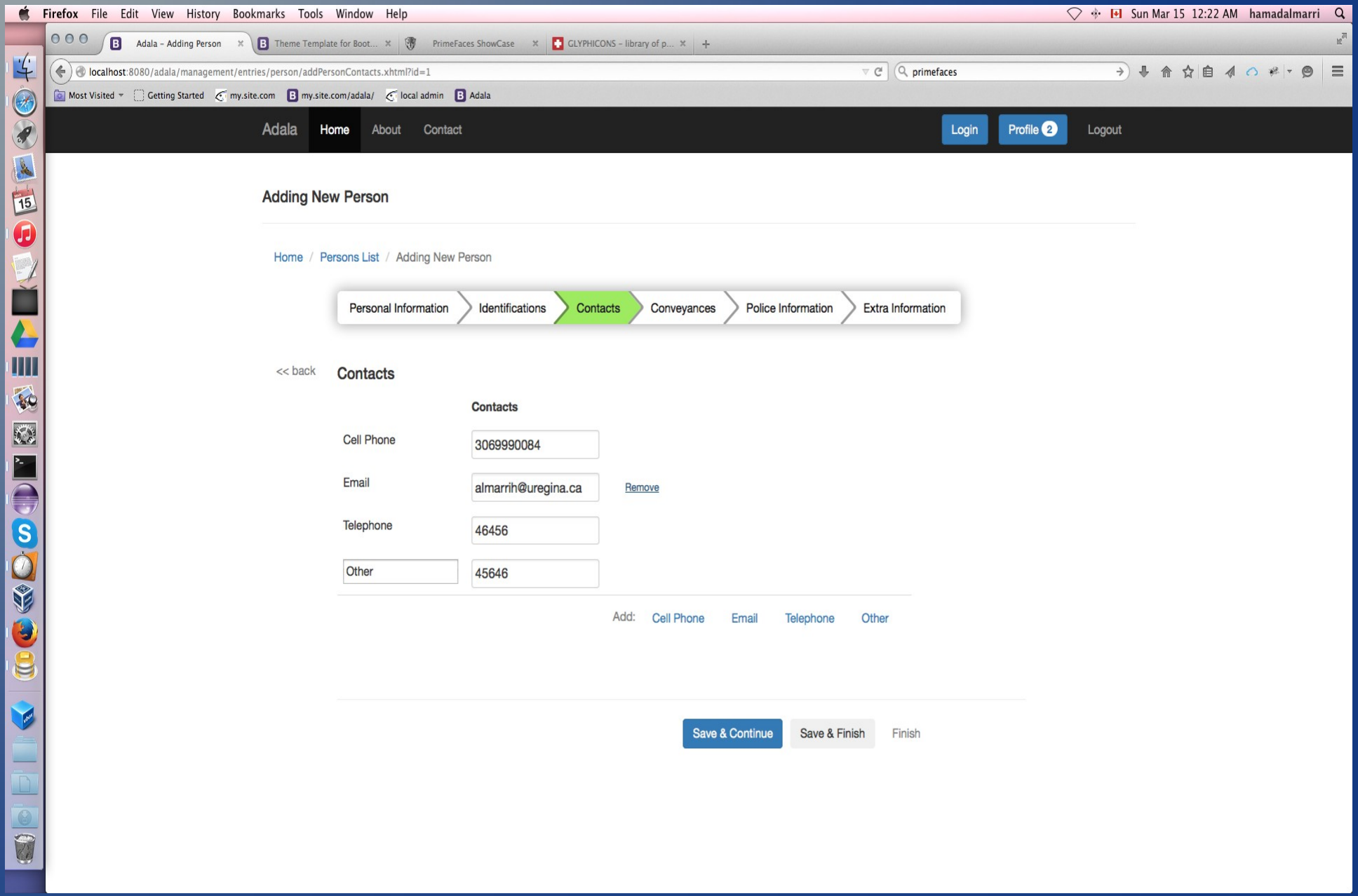

Persons list page

# Screen Shoots



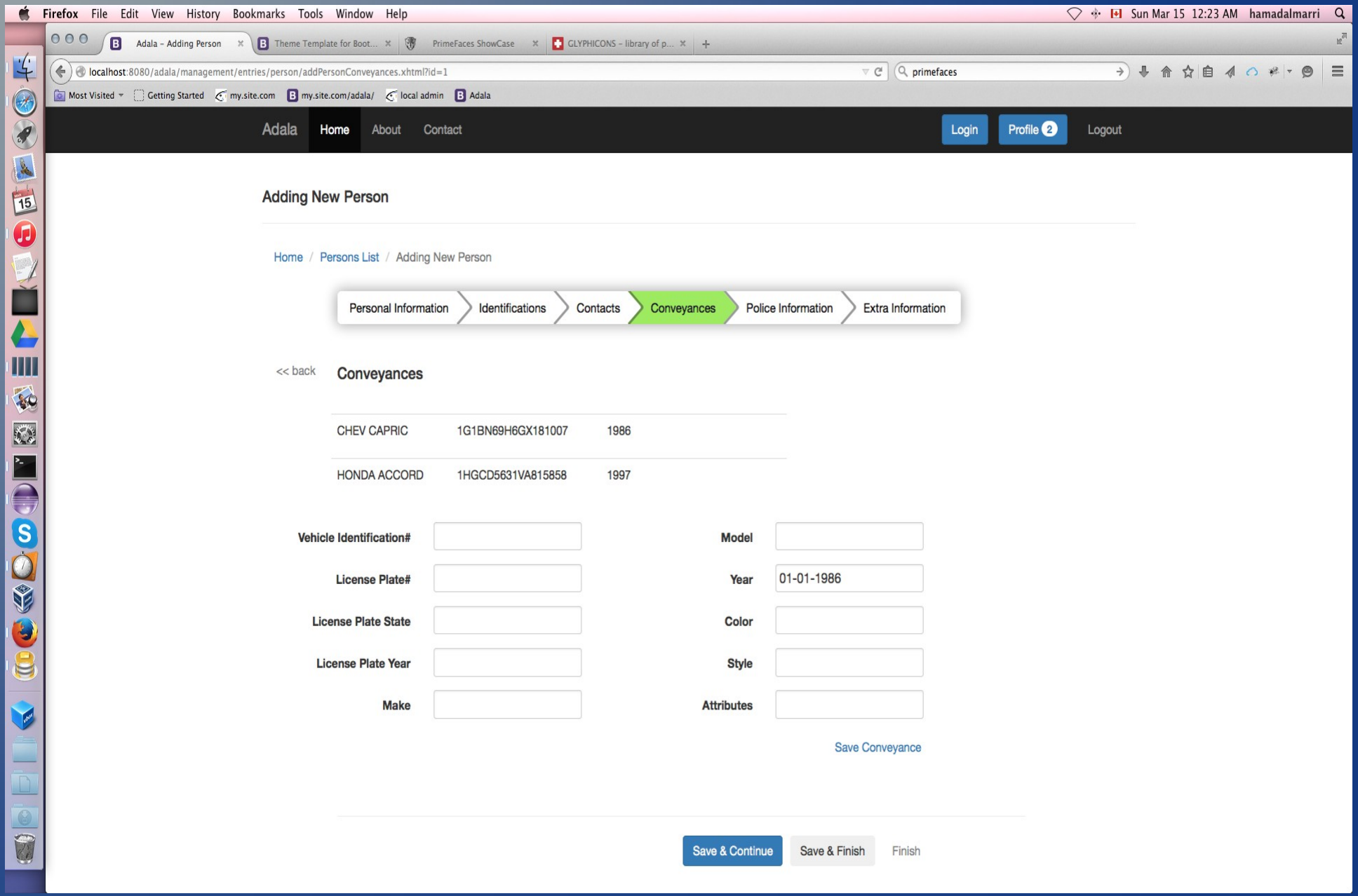

Persons list page

# Screen Shoots



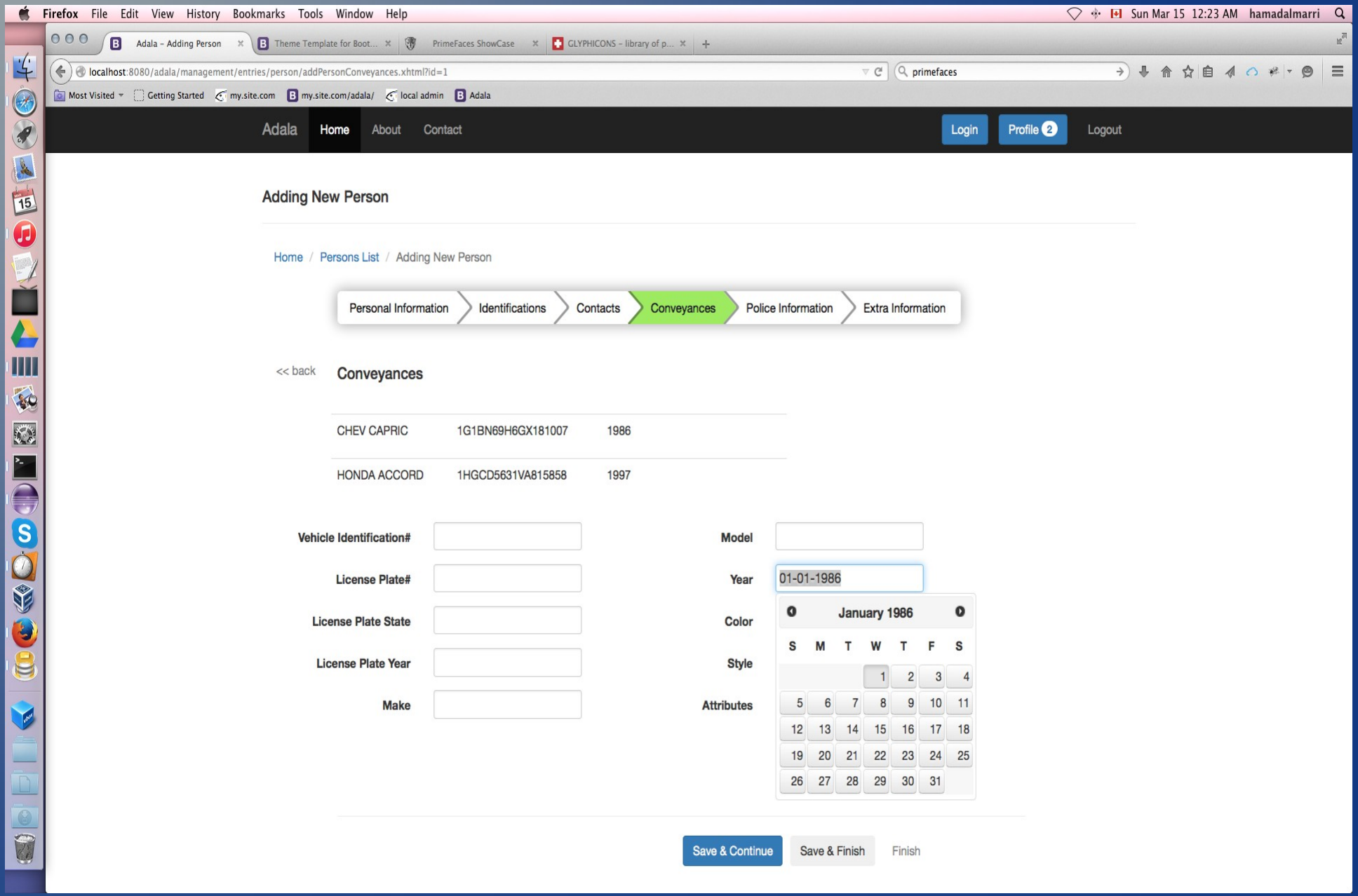

Persons list page

# Screen Shoots



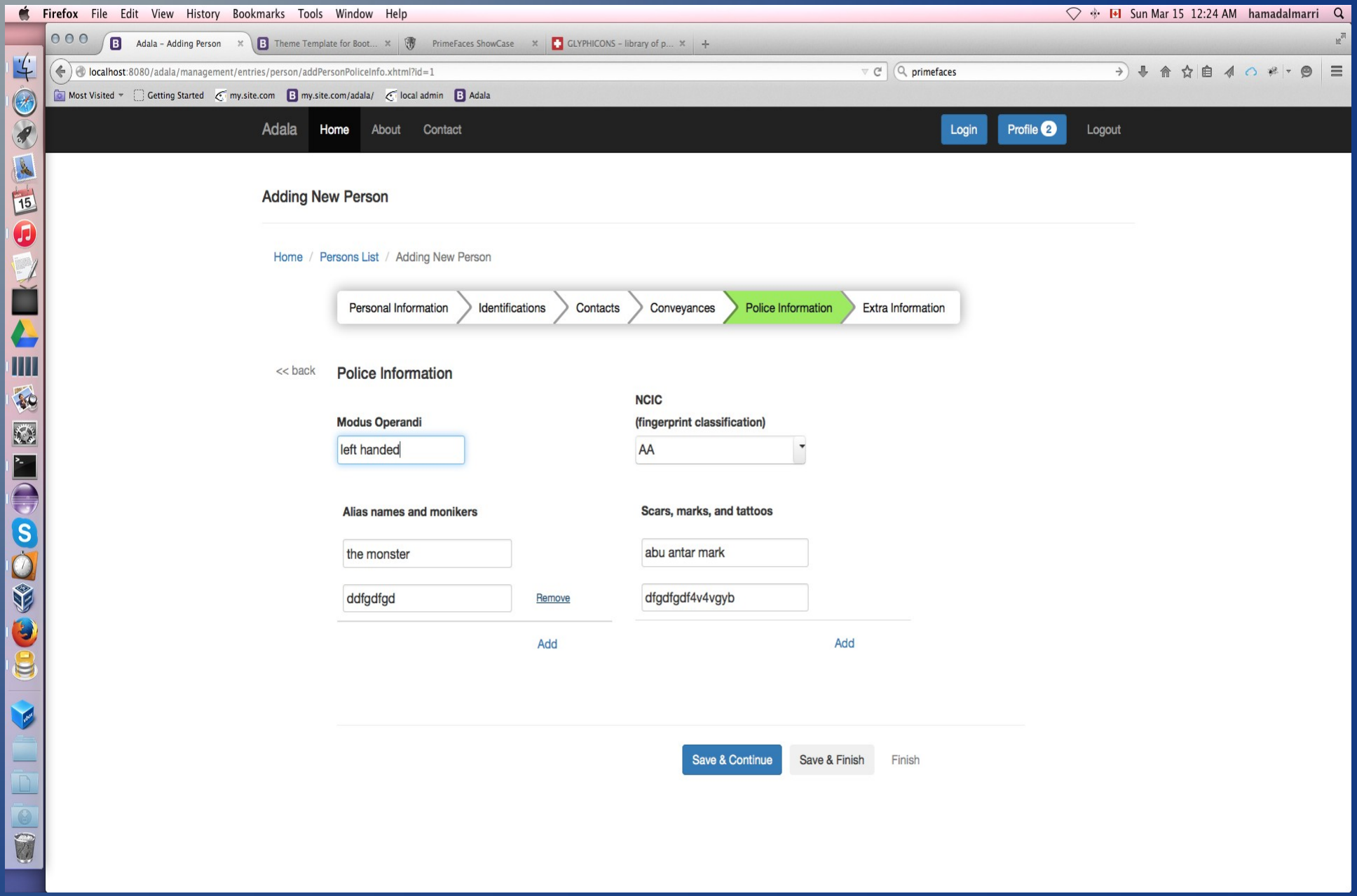

Persons list page

# Screen Shoots



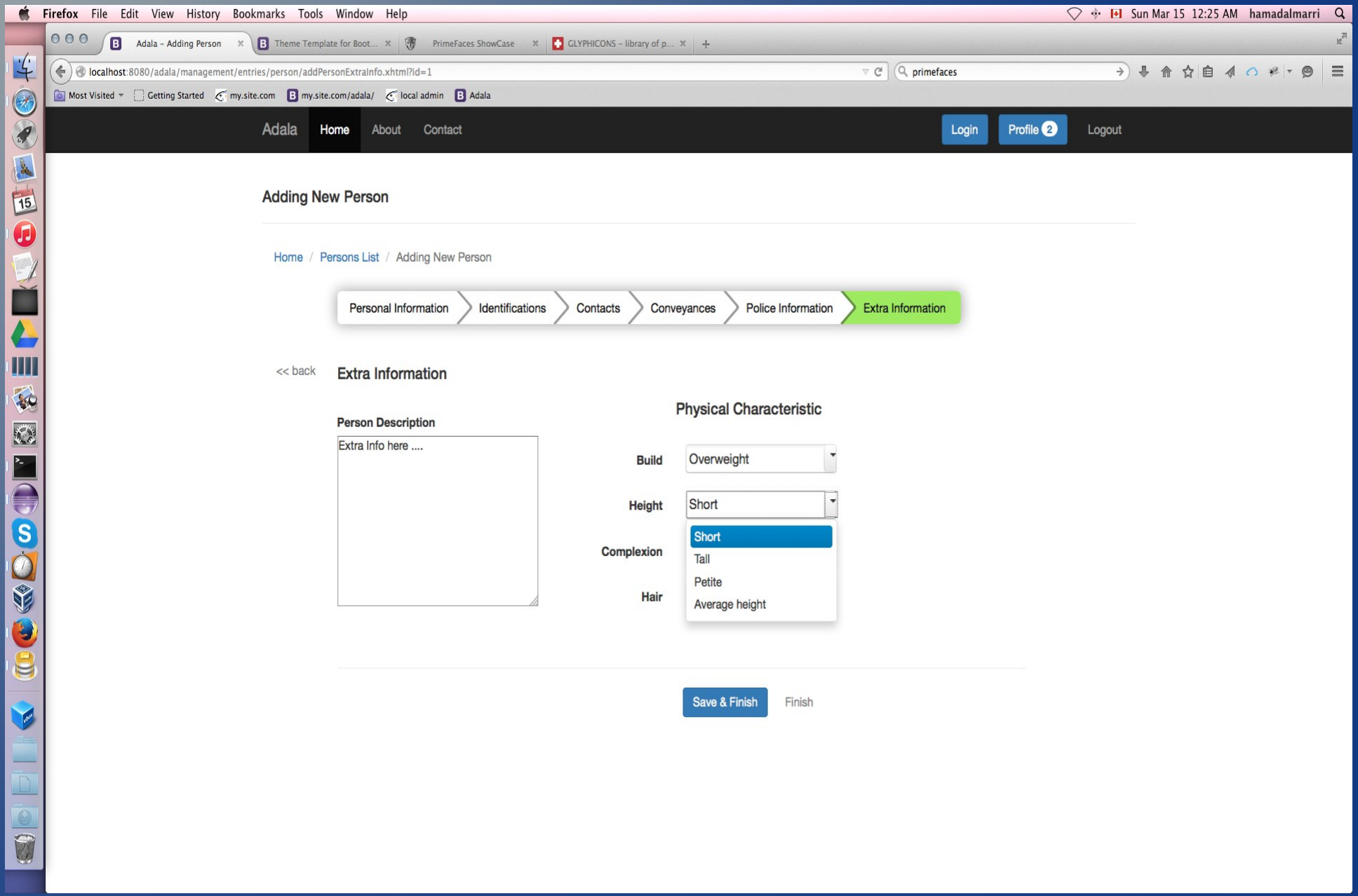

Persons list page

# Screen Shoots




Persons list page

# Screen Shoots




Persons list page

# What I have learned from this project in terms of Software Engineering

- Start with User-Driven development very early even if no real customer
- Don't depend and postpone the work for holiday and weekends

# Questions

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