SEEDING PHASE SOFTWARE ARCHITECTURE MODEL FOR VIRTUAL BUSINESS INCUBATORS

Alin-Cristian Joiţa[1]
Floarea Năstase[2]

ABSTRACT

The basic role of the virtual business incubator is to enhance the performance of its clients, to accelerate their growth mostly through virtual instruments for know-how, mentoring and networking. Often enough, for members to follow the incubation program they require funding. In order for a virtual business incubator to also provide a funding solution, this article analyzes crowd-funding principles, existing systems and proposes a model for a crowd-funding platform.

Studies show that crowd-funding is considered viable to a wide range of projects in different fields, such as economy, entertainment, art etc. In this manner, start-up members get exposure and funding from investors all over the world, whether they are simple individuals or international companies.

This system allows potential customers to gain a proactive role by becoming investors and participants to the success of the product and the company.

Keywords: crowd-funding, virtual business incubator, seeding stage, funding, software architecture
JEL Classification: *C61, C80*

1. INTRODUCTION

This paper proposes a conceptual model for a n-tier client-server application for financing activities through the contribution of the masses, a notion expressed in general English by the polysynthetic term "Crowd-funding". Along with this model, existing functional systems are reviewed. Thus, it argues for the importance of the subject, impact and necessity of these systems in society and economy and establishes common architectural elements.

Technology is probably the most important agent of change, contributing to the development of Information Society in which, national boundaries, geographical distances and physical obstacles become blurred and increasingly less relevant [17]. Today we stand at a critical point of maximum expansion and empowering technology for communication and interpersonal networks. Among the key elements of human existence, the need to relate with others ranks just below the need to sustain life.

Internet Globalization took a shorter time than it was expected, so that interaction in social, trade, political and personal environment changed in a fast pace, to suit the new paradigm. Global network existence and expansion has produced new forms of communication setting more power to individual expression and rapid access to a global audience [18].

[1] Teaching assistant, PhD student, Romanian-American University, Bucharest, Romania
joita.alin.cristian@profesor.rau.ro
[2] Professor, PhD, The Bucharest Academy of Economic Studies, Bucharest, Romania
nastasef@ase.ro

"Crowd-funding", a term inspired by "crowdsourcing" describes cooperation in large numbers, centralized transfer of information, trust and effort (especially financial effort) to support actions initiated by other persons or organizations. The Romanian equivalents of this term are ''multifinanțare'' or ''finanțare participativă'' ([25], [26] and [27]).

This concept is used not only online, being valid even in connection with campaigns to support political candidates in elections, to raise funds for humanitarian causes etc. One of the first examples to support an economic project in the online environment is that of Michael Migliozzi (marketing executive at Forza Migliozzi, advertising agency) and Brian Flatow (president of The Ad Store, advertising agency). The two, in an effort to save American beer and possibly to draw attention to themselves, have created www.BuyABeerCompany.com website through which, under the slogans "Save PBR", "Keep Milwaukee Proud" and "United Men, Women. Together we CAN save & buy Pabst Brewing Co. Spread the word" wanted to buy a brewery, each subscriber receiving shares. The idea was quickly challenged in court by the SEC (U.S. Securities and Exchange Commission) [9], bringing into question the position of crowd-funding projects in private business system[3]. Another project, developed successfully in Romania, over 125 years ago, was the financing of the Romanian Athenaeum, in Bucharest, through public subscription, with the slogan "Pay a Leu for the Athaenaeum!" .

The following projects, as stated in [1] have created the necessity for legislation in such transactions and collaborations. Thus, the United States introduced to the Senate the first legislative proposal in November 2, 2011[4]. The project proposal addressed crowd-funding applications where contributors offered money in exchange for shares, when the project was completed. The document set out a general legal framework, the most important features being [16]:

- Issuing of shares will take place through a specialized company (an intermediary like Kickstarter). Therefore, start-up companies will not be permitted to operate or maintain fundraising campaign through "social media" websites like Facebook, Twitter or LinkedIn;
- Each investor is limited to a maximum investment of $ 1,000 / year / company; a previous version allowed a maximum investment of $ 10,000 or up to 10 per cent of annual income of the investor;
- A limit is also set for collected capital, the maximum limit being one million dollars over a period of 12 months; preceding version allowed two million dollars, provided that potential investors be given the company's financial statements, obtained over an audit;
- Finally, it is required that an amount of 50 percent of investors to be residents.

In current form, the legislation only affects companies that organize crowd-funding activities and return shares to the investors, and not those that offer prizes in return for the money invested [4]. In 2012 and 2013, the law was reinforced with JOBS Act that included several crowd-funding regulations, as presented in [30] and [31]. Frequently, individuals

---

[3] The case is described and classified in SECURITIES ACT OF 1933 document, Release No. 9216 / June 8, 2011 (http://www.sec.gov/litigation/admin/2011/33-9216.pdf)

[4] Entire legislative text (''Entreprenuer Access to Capital Bill'') can be accessed online at the address http://rules.house.gov/Media/file/PDF_112_1/legislativetext/HR2930%201027 .pdf

who create a crowd-funding request, offer to send the product they design in return for the amount received as an investment. This type of investment cannot fall under the legislative proposal, as it is a sale in advance being enforceable.

In the EU, measures to legislate the crowd-funding phenomenon gain importance in 2013, with a European survey and law proposals [32].

In Romania, the legislation gained in September 2014 a law proposal, according to [33] and [34], and several programs were developed for sustaining and developing business and technological incubators. Evidence of these facts can be found on governmental website pages, such as [35], [36] and [37]. The legislative project concentrates on *equity-based crowdfunding*, *credit-based crowdfunding* and less on *donation-based or reward-based crowdfunding*.

While researching for existing systems, we took interest in a couple of crowd-funding solutions, found in most references. The most famous are Kickstarter (the most successful application for creative projects), RocketHub, Quirky (dedicated to support innovation projects), ProFounder (registering is conditioned by the type of the company – only allowed members are C-corp economic agents), Indie Go Go (created to finance campaigns and musical album launches). In Europe, some of the best known solutions are Ulule (France), Eppela (Italy), c-Crowd (Switzerland), Boomerang (Denmark), StartNext (Germany) etc.

In Romania crowdfunding phenomenon began to be noticed at the end of 2012, most known platforms being Arena Mieilor (arenamieilor.com), PotSiEu.ro, Multifinantare.ro, CrestemIdei.ro, WeAreHere.ro. CrowdFunding.UBBCluj (crowdfunding.alumni.ubbcluj.ro). The platforms were mentioned in national press, such as [23].

2. SOFTWARE MODEL ARCHITECTURE

The authors aimed at software architecture that could be integrated in virtual business incubators. According to information found in [2], [20] and [8] success in incubation programs depends largely on the ability to attract capital. The traditional system, even embedded in virtual incubators involves networking and promotion activities to attract investors (venture capitalists or angel investors) or contract a loan [14], [15]. In exchange for funding, companies must provide shares or take risks and suffer the effects arising from the inability to pay debts or the differences emerging in management with the new partners. The presented model aims at reducing or avoiding risks and adverse effects by creating diversity in fundraising traditional instruments for a virtual business incubator, by adding a crowd-funding module. This solution reduces reliance on credit agencies and gives customers a proactive role, participating in this way not only by consumption but also in the production and promotion processes, as mentioned in [13] and [3].

Key advantages encountered in this system are:

- Cheap way of raising funds,
- Low risk for investors thanks to the system of project selection and the small amounts allowed as a pledge,
- Promotes feedback from potential customers,

The *main disadvantages* of the system are:

- Taxpayers are not fully protected by fraud or racketeering,
- It may be difficult to collect a sum of money in short time,
- Disclosure of project may lead to theft of intellectual property.

3. THE ALGORITHM

The intent of this crowd-funding system is to create a "revolution through good deeds" - embodied by buying in advance the result, to maximize social and environmental impact, to increase capital for incubated companies [21].

We propose an algorithm in the next figure, which seeks to reduce the elapsed time from registering an application for funding until its resolution altogether increasing success rate.

Individuals or companies enrolled in the incubation program proposing a business idea, a product or a service join the crowd-funding program by completing a form. Information is stored in the database and then sent to the committee of experts belonging to the incubator. Each expert analyses the offers, interviews candidates and provide a rating from one to three (Poor, Average, Good) by filling in an electronic voting system. Points are awarded to the strength elements of the business model, to the level of team integrity, and to the nature of the needs being addressed. The tendency is to focus on projects that address urgent matters.

The evaluation is entirely done in an electronic environment, thus the geographic establishment of the expert team members is not relevant, creating the possibility to engage experts from all over the world.

If the project accumulates an average of 3 points, it is accepted or it could be accepted with reserves if the rating is closer to 2 points. Acceptance of the proposal introduces the next step, offer publishing, exposure for the offer to potential investors and then collecting funds via a payment processor. Unacceptable projects are announced via e-mail. Once the allotted time for fundraising has expired, money is sent to the originator of the project, if the amount reached the suggested minimum threshold or is returned to the financiers.
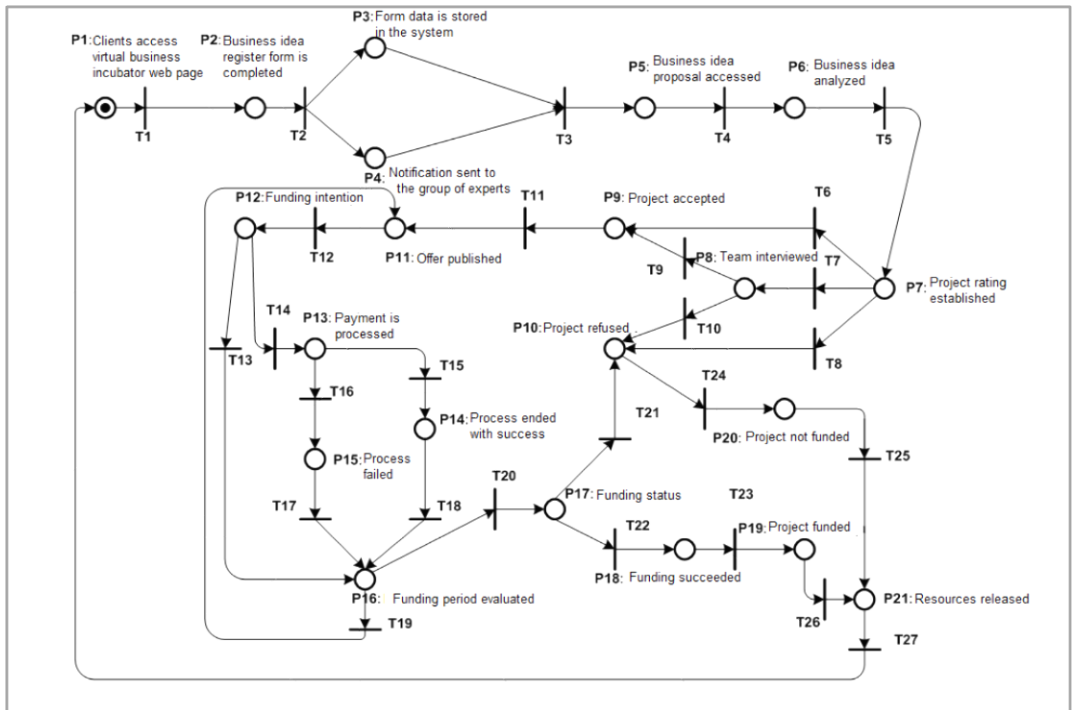
Figure 1 – Crowd-funding workflow

Table 1 – Workflow positions

POSITION	STATE
P1	Clients access virtual business incubator web page.
P2	Business idea register form (funding request) is completed.
P3	Form data is stored in the system.
P4	Notification sent to the group of experts.
P5	Business idea proposal accessed.
P6	Business idea analyzed.
P7	Project rating established.
P8	Team interviewed.
P9	Project accepted.
P10	Project refused.
P11	Offer publishing.
P12	Funding intention.
P13	Payment is processed.
P14	Payment process ended with success.
P15	Payment process ended with failure.
P16	Funding period evaluated.
P17	Funding status.
P18	Minimum threshold has been reached. Funding succeeded.
P19	Project funded.
P20	Project not funded.

P21	Resources released and returned to the investors.

Table 2 – Workflow transitions

TRANSITION	EVENT
T1	Registration form for funding the project is accessed; Client is registered or signed-in; Registration forms are displayed.
T2	Filled forms are sent to the server through POST; Validation process is executed for checking the format and types of data being transmitted; Data is stored in data warehouse; Project proposals list existing on the Server is updated; Hyperlinks to the new content are created; The result of processing is displayed Client-side; E-mail confirmation is sent to Client; Notification e-mails are automatically formulated and sent to expert group that will evaluate the funding request.
T3	Server generates a content web page for the new project; Experts access this page through a hyperlink added to the notification e-mail or by navigating inside the project section while being logged in.
T4	Members of the Experts commission analyze the funding request files and release notes to project's team and to the rest of the commission; Confirm the process of analysis of the request.
T5	Evaluation of the project is finalized by according the proper rating: 3 points – Good project 2 points – Average value – more input needed from project members 1 point – Unacceptable project
T6	Announcing the result of evaluation (3 points) and accepting the project
T7	Announcing the result of the evaluation (2 points) Establish an interview with project's team members Transmit interview prerequisites
T8	Announcing the result of the interview (1 point) and the decline to include the project in crowd-funding program
T9	Analyzing answers received during the interview Project acceptance
T10	Analyzing answers received during the interview Project denial
T11	Uploading information on the server by project team members. This can be in the format of text, audio-video or attachments, in order to present and promote best the project idea to be funded Funding options are created – the value of investor's participation and the reward (optional) for this participation

	Web content generation by the server, based on the uploaded and stored information
T12	Project offer is displayed in the public area of the crowd-funding module
The funding intention assumes the following actions:
Signing-up the investor and completing the profile and payment information input
Selecting a funding option from the selected project
T13	Current project is analyzed in extensor or other are accessed
T14	The user with an investor role is redirected to the payment integrator's platform
Payment information is inserted
Data from form is validated
T15	Payment is made
Confirmation message is sent to the investor
Project page is updated with the new total
T16	In case of inserting invalid information or an error of processing or transmission the user is notified by redirecting the browser to an exception page
If Retry is chosen, the process is resumed
In case of Canceling, payment process fails
T17	A message is sent to the user announcing the result of the transaction and presenting an option to redirect to project web page
T18	A message is sent to the user announcing the result of the transaction and presenting an option to redirect to project web page
T19	Project's constraints are still valid (eg. Period for raising funds hasn't expired)
Viewing and funding is still permited to the visitors
T20	Project's time period expired
Project's web page is modified:
The button for funding function is hidden
Grand total is displayed
The web page can still be viewed, but funding is not permitted anymore
T21	Collected sum is below the needed threshold established by project team members
T22	Collected sum is above or equal to the threshold established by project team members
T23	Payment integrator platform transfers funds to project team members, incubator fee and payment processor fee
T24	Payment integrator platform transfers funds back to all investors, minus the payment processor fee
T25	All investors are notified of the project's success
T26	All investors are notified of the project's failure
T27	Project is archived
Can be viewed, but comments or funding cannot be added anymore
Cycle is restarted for a new project

For the register application form, the following fields are recommended: name, email, amount of funding needed, link to company's website, portfolio, blog or YouTube video or any other material that could better describe the proposed project to be supported. Next, a description of the need that the entrepreneur assumes it was not yet satisfied by the other existent solutions. Following this field, a business model description should be added, a description of offer (the results arising from the project). Attach files input fields (business plan, resumes, pictures) should be inserted in the interface, which could convince even more on the quality and necessity of the project. In the end, the project should be added to a domain or category catalogue.

Each project that is accepted causes on the HTTP server the creation of a microsite, where one can find author's data, project description, similar projects on this site, either underway or completed, belonging to the same author. The information entered can be text, image and video. Video data are stored in 3rd Party system, on a multimedia portal (e.g. YouTube, Vimeo) which provides API libraries for control. Information on third party online multimedia storage environments is found in [7] and [19]. In order not to exist discrepancies between the offer description approved and the description displayed, all microsites are monitored.

On this platform, individuals (referred to here as investors), that assume the role of micro-investors or buyers browse existing projects and if they are convinced, can choose an amount to fund one or more initiatives presented on the website. In return, they will receive prizes set by project managers and posted on the project web page. The success of a project depends on the involvement of customers-investors in promoting the idea. In the model, it is not taken into account any upper age limit as an investor nor any limitations related to its geographical position.

When a payment takes place, a payment processor is accessed as a third party technology. If there is a processing fee, it is supported by the investor.

Each project has a period of 60 days or less, to collect the minimum amount needed that was declared in the registration stage. The system requires that funding be allocated to the project only if they collect the full amount requested. If the target is not reached, the money is returned to investors. Whatever the result, investors will receive a notice.

4. PROPOSED MODEL

For the crowd-funding module associated to the virtual business incubator, we propose a conceptual model using Entity-Relationship and UML diagrams. The main entities and relations are expressed in the following scheme:
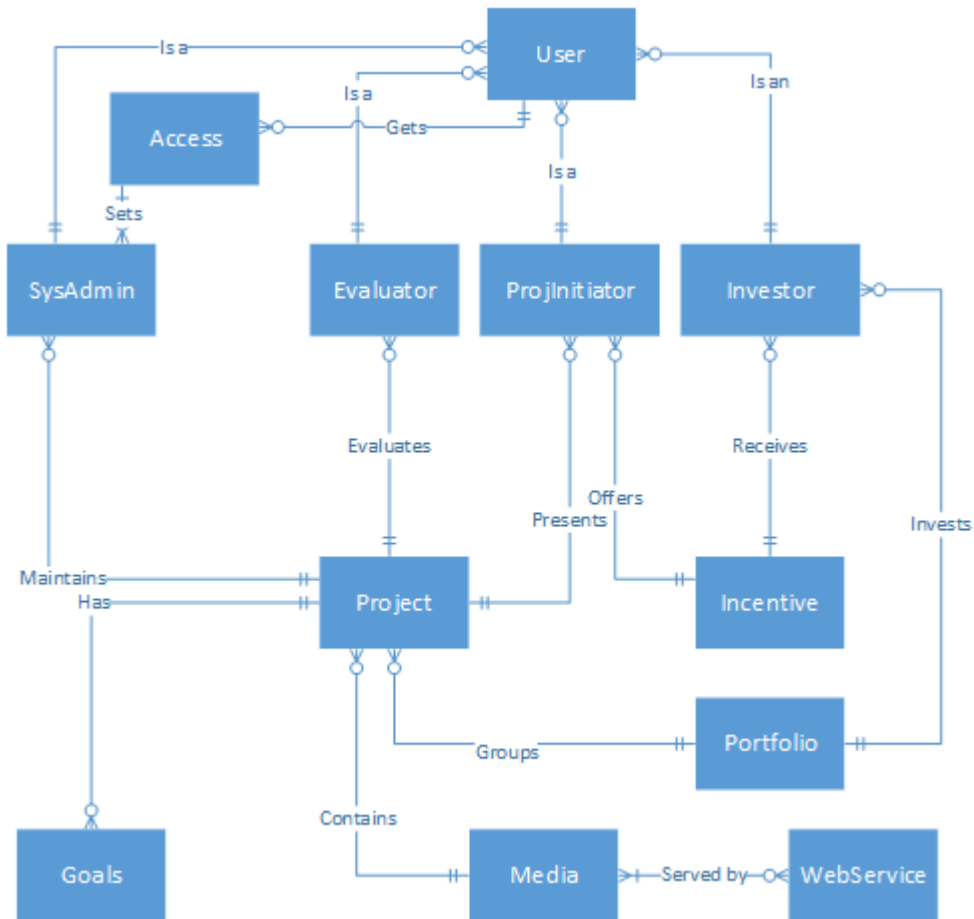
Figure 2 – Entity-Relationship Diagram

Functionalities needed for a crowd-funding system can be grouped on three levels, as displayed in the next diagram:
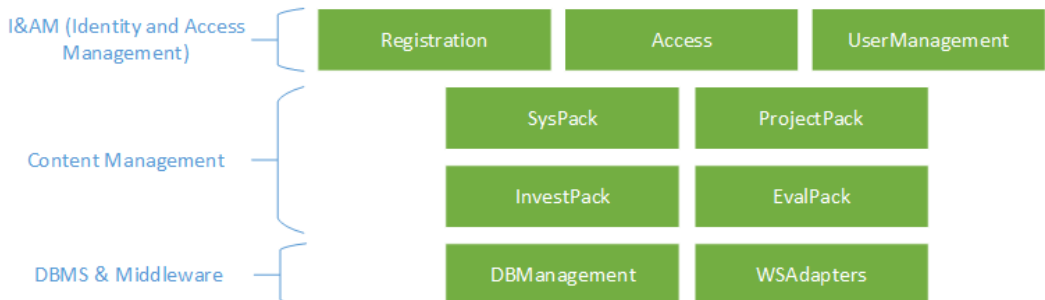

Figure 3 – Main functionalities packages

The model is intended to be implemented as a technology mash-up. For example, user registration and account management are to be used with social networks accounts with Single-Sign On (SSO) technology, while content management in Project pages will integrate text, pictures, audio and video streams and information from embedded plugins and Web Services.

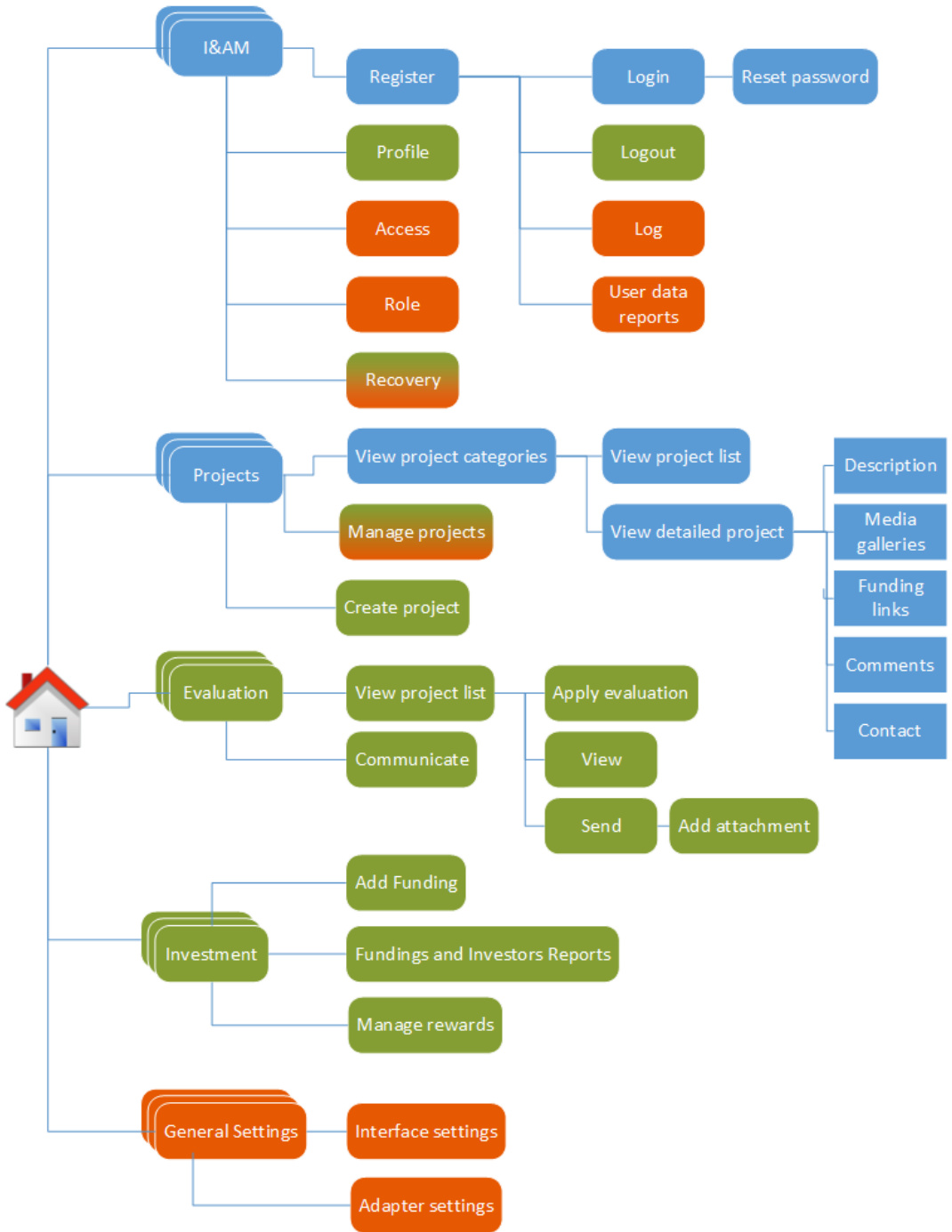The structure of the application can is explained with the site map diagram.

The module is proposed to be associated with a client-server multi-tier architecture, the server being composed as following:

- Presentation Logic Web Tier or the Gateway - is implemented as an HTTP server, receives client requests and returns a response. Most responses are text based including HTML, XML, JSON, but can also be binary files (images, SWF etc.). Where new information is necessary without reloading the page, AJAX technologies are applied.

This level contains the data display mechanism. When loading a page, the Client layer passes the request to the Presentation Layer on the Server. In this context, header analysis of the request message leads to returning the demanded web page type containing a page template. Objects received from the Business tier are processed based on formatting rules and used to populate the template with data. API or SOAP requests are issued to 3rd Party services to receive the necessary external objects. References to external libraries being used are added to the template and the final result is sent to the customer.

In order to work with formatting standards, it is appropriate to use Boilerplate templates, JavaScript Frameworks like JQuery, Mootools, Scriptaculous, Google products (Google API), Yahoo (YUI) or JavaScript libraries such as Modernizr;

- Business Tier - implements the logical model (Business Logic) via an Application Server. In our model's implementation, applications that deal with the essential rules of data processing are part of Zend Framework collection;
- Data Tier - implemented as a MySQL Database Server.
- The multi-tier feature states that the model includes various software packages installed on different servers designed to work together through the use of Web standard technologies.

Figure 4 – Site map diagram

5. SUMMARY AND CONCLUSIONS

The proposed model for implementation of crowd-funding techniques is a new fundraising concept for the virtual business incubators. The initiative is justified because research on this type of incubators has placed seeding or financing among the most important steps ([2], [6], [8] and [20]) and this material also contributes to a better understanding of the phenomenon.

The model presents itself as a platform for business funding for companies included in the virtual business incubation programs. In this system, potential customers gain a proactive role by becoming investors and participants to the success of the product by promoting the project.

Crowd-funding is considered a viable solution for virtual business incubators [12]. Different industry reports and survey sources including Harvard Business Review summed up the contributions offered on crowd-funding platforms to a total value of 65 billion dollars, creating 270 thousand jobs and forecasts for 2020 a value of 500 billion dollars and 3.2 trillion dollars in economic value per year.

Future research aims at creating a complete model for a virtual business incubator with tools for every stage of incubation.

6. REFERENCES

[1] Agrawal, A., Catalini, C., Goldfarb, A. (2010).Entrepreneurial Finance and the Flat-World Hypothesis: Evidence from Crowd-Funding Entrepreneurs in the Arts, Working Papers, NET Institute.
[2] Bergek, A. N. (2008). Incubator best practice: A framework. Technovation, Vol. 28(No. 1-2), pp. 20-28, ISSN 0166-4972.
[3] Blazevic, V., & Lievens, A. (2008). Managing innovation through customer coproduced knowledge in electronic services: an exploratory study. Journal of the Academy of Marketing Science, Vol. 36(No. 1), pp. 138-151, ISSN 0309-0566
[4] Bradford, C. S. (2012). Crowd-funding and the Federal Securities Laws. Columbia Business Law Review, Vol. 2001(No. 1), ISSN 0898-0721.
[5] Căruțașu, G. C., Joița, A.C. (2009). Managing Unstructured Data in Implementation of the Integrated Management System (DI - IMS). 16th International Economic Conference, pp. 10-16, ISSN 0309-0566.
[6] Chen, C. (2009). Technology commercialization, incubator and venture capital, and new venture performance. Journal of Business Research, Vol. 62(No. 1), pp. 93-103, ISSN 0148-2963.
[7] Ferrell L., Ferrell, O.C. (2012). Redirecting direct selling: High-touch embraces high-tech, Business Horizons, Volume 55, Issue 3, May–June 2012, Pages 273-281, ISSN 0007-6813.
[8] Hackett, S. D. (2004). A systematic review of business incubation research. Journal of Technology Transfer, Vol. 29(No. 1), pp. 55-82, ISSN 0892-9912.
[9] Hazen, T. L. (2012). Crowdfunding or Fraudfunding? Social Networks and the Securities Laws – Why any Specially Tailored Exemption Should be Conditioned on Meaningful Disclosure. North Carolina Law Review, Forthcoming, Vol. 92(No. 1), ISSN: 0029-2524
[10] Hernández-Orallo E., Vila-Carbó J. (2009).Web server performance analysis using histogram workload models, Computer Networks, Vol. 53 (No. 15), pp. 2727-2739, ISSN 1389-1286
[11] Joița A.-C., Căruțașu, G. (2010). Technology And Business Incubator Centers -Adding Support To Small And Medium Enterprises In The Information Society. 17th International Economic Conference The Economic World' Destiny: Crisis and Globalization?, pp. 107-115, ISBN 978-973-739-987-8.

[12] Niall F. (2012). Crowd-funding successes show value of small donations. The New Scientist, Vol. 213 (No. 2858), pp. 22, ISSN 0262-4079, 10.1016/S0262-4079(12)60817-3.

[13] Ordanini, A., Miceli, L., Pizzetti, M., & Parasuraman, A. (2011). Crowd-funding: transforming customers into investors through innovative service platforms. Journal of Service Management, Vol. 22 (No. 4), pp. 443 – 470, ISSN 1757-5818.

[14] Peters, L., Rice, M., & Sundararajan, M. (2004). The role of incubators in the entrepreneurial process. Journal of Technology Transfer, Vol. 29 (No. 1), pp. 83-91, ISSN 0892-9912.

[15] Phan, P. S. (2005). Science parks and incubators: observations, synthesis and future research. Journal of Business Venturing, Vol. 20 (No. 2), pp. 165-182, ISSN 0883-9026.

[16] Pope, N. D. (2011). Crowdfunding Microstartups: It's Time for the Securities and Exchange Commission to Approve a Small Offering Exemption. University of Pennsylvania Journal of Business Law, Vol. 13 (No. 4), pp. 101-129, ISSN 1940-8064.

[17] Roşca, Ion. Gh., Ghilic-Micu, B. (2006). Informatica. Societatea Informaţională. E-Serviciile. Bucureşti: Editura Economică, ISBN 978-973-709-266-3.

[18] Roşca Ion Gh., Ghilic-Micu, B., Stoica C. (2004). Comerţul electronic - concepte, tehnologii şi aplicaţii. Bucureşti: Editura Economică, ISBN 973-590-989-8.

[19] Rotman, D., Golbeck, J. (2011). Chapter 14 - YouTube: Contrasting Patterns of Content, Interaction, and Prominence, Analyzing Social Media Networks with NodeXL, Morgan Kaufmann, pp. 225-246, ISBN 978-012-382-229-1.

[20] Scillitoe J.L., C. A. (2010). The role of incubator interactions in assisting new ventures. Technovation, Vol. 30(No. 3), pp. 155-167, ISSN 0166-4972.

[21] Springhetti J.(2011). Microfinance pioneer shifts to new crowds. Stanford Business Magazine Online, Vol. 79 (No. 3), pp. 14-17, ISSN 1094-5423.

[22]Vipul M., Varsha A.(2009). An overhead and resource contention aware analytical model for overloaded Web servers, Journal of Systems and Software, Vol. 82 (No. 1), pp. 39-55, ISSN 0164-1212.

[23] Cum iti finanţezi afacerea din donaţii, http://www.incont.ro/idei-de-afaceri/cum-iti-finantezi-afacerea-din-donatii-platformele-de-crowdfunding-au-inceput-sa-castige-teren-si-in-romania.html

[24] Mai multe sanse pentru antreprenoriat prin finanţarea participativă, http://www.capital.ro/mai-multe-sanse-pentru-antreprenoriat-prin-finantarea-participativa-.html

[25] Despre Legea privind Dezvoltarea Finantarilor Participative (Crowdfunding), http://laurentiumihai.ro/interviu-mirel-borodi-despre-crowdfuding/

[26] Mai multe şanse pentru antreprenoriat prin finanţarea participativă, www.infolegal.ro/incubatoare-de-afaceri-pentru-imm-uri/2014/10/30/

[27] Crowdfunding-ul sau multifinaţarea – noua metodă alternativă de finanţare, www.juridice.ro/291168/crowdfunding-ul-sau-multifinatarea-noua-metoda-alternativa-de-finantare.html

[28] Nastase Floarea, Timofte Carmen, 2004, Tehnologia afacerilor pe Internet, Ed. ASE, Bucuresti, (CD-ROM)

[29] Nastase Floarea, 2005, Web Services Security, The Impact of European Integration on the National Economy - Business Information Systems, Cluj-Napoca, Editura Risoprint

[30] SEC Issues Proposal on Crowdfunding, http://www.sec.gov/News/PressRelease/Detail/PressRelease/1370540017677#.VHFJHmc085o

[31] The Crowdfund Act, https://www.crowdfunder.com/blog/knowledge-center/crowdfunding-law/

[32] Review of Crowdfunding Regulation 2013, http://www.europecrowdfunding.org/2013/10/review-crowdfunding-regulation-2013/

[33] Proiect de Lege privind dezvoltarea finanţării participative – crowdfunding, http://imm.gov.ro/CMS/0/PublicMedia/GetIncludedFile?id=520

[34] Lege privind Incubatoarele de afaceri, http://imm.gov.ro/CMS/0/PublicMedia/GetIncludedFile?id=452,

[35] Programul de înfiinţare şi dezvoltare de incubatoare tehnologice şi de afaceri, imm.gov.ro/79/82/Programul-de-infiintare-si-dezvoltare-de-incubatoare-tehnologice-si-de-afaceri/Programul-de-infiintare-si-dezvoltare-de-incubatoare-tehnologice-si-de-afaceri

[36] Programul INCUBATOARE, www.aippimm.ro/categorie/programe/programul-incubatoare/

[37] Programul naţional multianual de înfiinţare şi dezvoltare de incubatoare tehnologice şi de afaceri, www.aippimm.ro/categorie/programe/programul-na-355-ional-multianual-de-nfiin-355-are-351-i-dezvoltare-de-incubatoare-tehnologice-351-i-de-afaceri/