Implementation of Prototyping Method on Smart Village Application

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Abstract. Software development has many methods which are divided into traditional and agile categories. Traditional methods are known as heavy, rigid methods and have a lot of documentation, while agile is known as a lightweight, fast and a little documentation method. But there is a traditional method that has the flexibility and speed like the agile method, namely the prototyping method. Several prototyping methods are often used in building an application. The research aims to choose the right prototyping method for building a smart village application. The smart village application can be categorized as an application that requires a lot of communication with the user, where the user is a village community who has a certain culture and has a variety of educational backgrounds. The results of this study are that prototyping methods that are suitable for building smart village applications are evolutionary prototyping.

1. Introduction

Software development methodologies have grown very fast. They had experienced very rapid development from time to time. The emergence of new methods of software development based on the need to find a development software method that fasts and can meet all the requirements that have been set for each case, of course with lower costs.

According to Dennis software development methodologies are Waterfall, Rapid Application Development (RAD) and Agile [1]. RAD is emerging to overcome the weaknesses of The Waterfall. There are two types of Prototyping in RAD methodologies System Prototyping and Throwaway Prototyping. Each type has different characteristics. Other literature said there are two types of prototyping, Evolutionary and throwaway prototyping[2]. System and Evolutionary Prototyping had something in common, there the prototype evolve into the final system. The definition of throwaway prototyping on both literature [1,2] are similar, which is a prototype was build to help discover requirements and then discarded. Prototyping methodology or paradigm can assist developers and stakeholder to better understand what is to build when requirements are fuzzy [3].

Smart village concept refers to the rural area and its communities which build their strengths and assets as well as developing new opportunities [4]. Smart village defined as a bundle of services which are delivered to its residents and businesses effectively and efficiently. Computing, communication and information technologies play in major rule in design, delivery, and monitoring of the services [5].

The smart village does not only bring internet connection or other information technology to the village but it also brings benefits to the communities or villager to improve the quality of life. his research implementing prototyping methods in developing a particularly smart village application with unique characteristics.

2. Related works

Several numbers of literature that explore prototyping methods. Sadabadi A T described the throwaway or rapid, evolutionary and incremental prototyping [6]. A brief conclusion can be derived from [6] which are the most obvious reason for using throwaway or rapid prototyping is prototype can be done quickly after a relatively short investigation. Speed is very crucial in implementing a throwaway prototype since there is a limit of time and budget because the prototype will be discarded. Unlike the throwaway, the evolutionary build a robust prototype at the beginning and constantly refined until the final system fulfilled and the system built functionality, so they may be used on interim until the final system delivered. Incremental prototyping builds the system into a separate prototype and at the end, the prototypes will be merged to the overall design.

Other research conducted by Nacheva R compare three prototyping approaches, exploratory, experimental and evolutionary [7]. Nacheva was mapping three types of prototyping in a line based on their fidelity. Figure 1 shown the mapping of prototypes based on their fidelity.
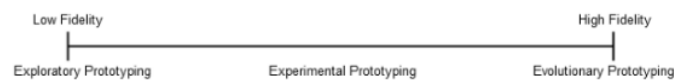
Figure 1. Prototype's fidelity in different approaches [7]

Evolutionary prototyping has a high fidelity which is the prototypes can be used for presenting key product features and usability testing and evaluation. According to Mecconel [8] evolutionary prototyping is a development approach in which you develop selected parts of a system first and then evolve the rest of the system from those parts.

There are another type of prototyping Continuous Prototyping [9] and Abstract Prototyping [10]. Continuous prototyping the prototypes are delivered continuously to the stakeholder. The stakeholder will received prototypes from the the first mockup to the finished product. Abstract Prototyping is pre-implemetary testing approach based on low fidelity prototypes. It allow the designer to optimze the operation of the system and allow end users to understand how to work with the system.

Based on facts that explained above there are many type of prototyping methodologies, the implementation of each type defend on the case that the developers deal with. Agustiono used the Evolutionary Prototyping on the case where the requirements frequently changed [11]. The research are used to develop Land Management Information System (pseudonym), initiated by the Australian government, for use by farmers to meet regulatory demand requested by Soil and Land Conservation Act. Tabel 1 shows the comparison of prototyping approaches by Nacheva. Nacheva described the goal, object of research, fidelity and results.

Tabel 1 Comparison of prototyping approaches[7]

Goal	Exploratory	Experimental	Evolutionary
Goal	Study: Clarification of system requirements and	Evaluation: Conducting user testing, to find out whether the technical solution satisfy the	Change adaptation : constantly adapt the system to dinamically changing the

	discuss different alternatives for implementation	system requirements.	enviroment
Object of research	Systems Requirements	Partially realized solutions	Detailed system requirements
Fidelity	Low	Medium	High
Result (engagement with the final system)	Rapid (presentation) prototype	Rapid (presentation) prototype or components (functional prototype)	Pilot system or Final System

3. The case studi

The smart village application in this study is a smart village application to promoting and managing the tourism potencies of a village.

3.1. The village's characteristics

A village that has many tourism potencies such are cultural attractions, tourism site, art shop, culanary and homestay. The communities of such villages usually had a kind hospitallity and openminded. They aware to the current technology advances. Tabel 2 shows tourism potency businesses of the village that gathered in this research.

Tabel 2. Tourism Potencies of the village

No	Tourism Potencies
1	Art shop
2	Culinary
3	Tourism site
4	Homestay

Tabel 3 shows main business processes of the tourism potencies.

Tabel 3 Business processes of tourism potencies

Business	Main Business Process	Products	Owner
Culanary	Selling	Food & Beverage	Villagers
Art shop	Selling, ordering	Handycrafts, painting, clothes	Villagers
Home stay	Rentals, booking	Room, servises	Villagers, village
Tourism site	Promoting, ticketing	Attractions	Village

3.2. The villagers

The community or the villagers has various backgrounds and ages. Most of them have middle level of education and have ability to communicate with tourist in english. They have a strong motivation to improve their abilities to encourage their income. Along with the emerging in communication technologies many of them become active users both for social media or other web-based applications, this fact leads us to a conclusion that the use of computer or mobile based application is a part of their daily lives.

4. Choosing the method

Village with unique charateristics become an interesting object to explore. Village with many tourism potency known as tourism village. Villagers in a tourist village have certain activities continuously to maintain the income of their tourism businesses. It is important for them to maintain continuity of their business, because the competition among other similar business in their neightborhood are high. Most of them rely on the activities or businesses of tourism and made it become main income.

The businesses in tourism village have several issue in common, which are the business owned by villager or the community, scope of the business is small to medium and adjacent to each other. The differencies of the businesses are layed on the business process. For example in the culinary the main business process is to sale foods and the beverages, the promotion are focused in the menu. The menu has to be interesting and look tasty. They need good pictures or photos of the dish. The artshop businesses one of the core business of tourism village. The artshop owner has to promote their products and manage the selling, to enhanced the selling volume the need a good promotion and worldwide. They must have various selling methods to achieved maximum selling.

The two other businesses of tourism village are homestay and tourism attraction. The homestay need to promote room and its services to attracting guesses. Tourism attraction usually owned by the village and become an issue to be manage by village officials. As a component in tourism village, promotion and management the tourist attraction or tourism site are the important things have to be done in correct way.

Something in common of the tourism businesses are the promotion and management to bring the business to the next level. Based on the fact that the communities are familiar with social media and web based applications therefore an online application is needed. The application must accomodate the promotion and managing of all main needs of the tourism businesses in the village.

4.1. Prototyping methods

Applying the suitable methods of prototyping for the smart village application based on the circumtances that occured in the village. Based on the circumtances around the village there are two analysis of implementing prototyping approaches.

4.1.1. Throwaway Prototyping. The obvious reason to use throwaway prototyping is prototype can be done quickly after a short investigation [6]. The limited time and budget also became one of the considerations to use this approach. The early prototype that build will be discarded. Based on the data are gathered on the research the need of the application is to increase the revenue of villagers by promotions of the bussiness wider. They The activities carried out by residents in the tourism village centered on how to run their business every day. They run it without thinking about the future sustainability. They realize that online promotions can help them to promote their business more broadly. But they don't have enough time if they have to be involved intensively in developing a prototype. The fact that the prototype of the application they want will later be discarded can destroy the establisehed connection. This is something that must be considered. Community willingness and good cooperation must be maintained. Regardless the need online promotions, they want that the businesses can run as usual. The throwaway prototyping build a prototype that far from the desired need. The village and their community need a applications the suitable enough to their need. They need a whole system description that can meet their needs to promote their business. Therefor the throwaway prototyping approach is not appropriate.

4.1.2. Evolutionary Prototyping. The prototype can be used as a product that will undergo developments to suit the requirements. There are several ways to collect the requirements, including observation, interviews and through surveys. The data obtained from observations, interviews with the village government and the villagers and the distribution of questionnaires to the owner of the villager's businesses. The evolutionary prototyping need the requirements clear enough in the beginning of the developing. The prototype can be used as pilot system [7]. This makes the evolutionary approach more reasonable to use. The village government and its people get a fairly clear picture of its application and usefulness. There are several referencies of evolutinary prototyping. The the similarity is that evolutinary prototyping develop a software by build a prototype that will continue to be evaluated and refined until it meets the requirements that have been determined. Figure 2 shows the evolutinary prototyping based on process approach designed by Nacheva [7].
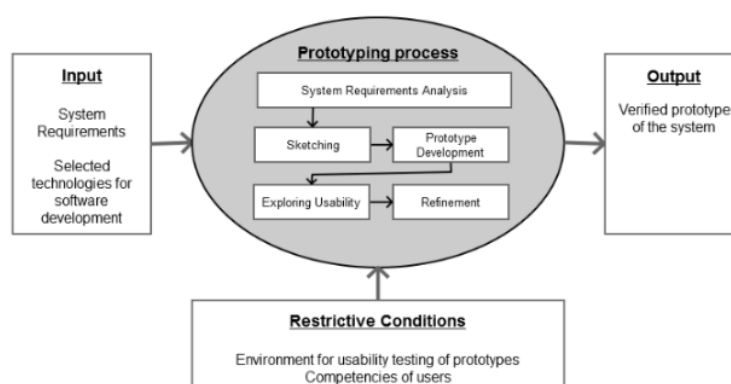
Figure 2. Evolutionary Prototyping based on process approach

The reason to used the evolutionary prototyping based on process approach based on the restrictive conditions. The tourism village has some unique characteristics. The characteristic can be the restrictive conditions, in this case users of the application are village's government and the villagers.

4.2. The Processes

The input of the application should be based on system requirements. The application designed to facilitate and help the village government and villagers promoting their potencies. The technology that choosed for this application are web and mobile application. This is based on the fact that almost all villagers are familiar with mobile technology and social media. The requirements is to manage and promote the potencies of tourism in the village. The village government must be the administrator to run the whole application. The reason is to place the village management responsibilities on the village side as the official agency representing the government. The output of a evolutionary prototyping is the verified prototyping of the system. Once the prototype was verified its can be admitted as pilot or final system depends on the decision between village government and the developer. The usability testing of the prototype plays an important way to decided whether the users are satisfied enough or not. The villagers have various education background and ages, it can be a chalange to build the application.

5. Conclusion

Evolutionary prototyping is one method that is often used to develop a software that requires a model or prototype to give an overview of applications to the users. The smart village application is an application where the main users are the village government and villagers, to provide a direct description of the functions and usability of the application must go through a prototype, so that users have a clear picture of the application. The evolutionary prototyping is appropriate to develop smart village application.

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