# Context Aware Personal Agent for Spiritual Exploration

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*Abstract*—This paper describes a personal agent to assist users in dealing with personal and psycho-spiritual issues. As Internet-based applications move beyond simple information presentation and social networking, the use of agent technology to create a personal, customized, and comforting presence becomes possible. This ability derives from an agent implementation that can offer thousands of years of spiritual and psychological wisdom from multiple traditions indexed by a specific life issue. A recommendation engine is shown which references a user's history, a community ratings system, and a recurrence engine to help a user in need explore profound issues encountered in daily life.

*Keywords*—agent, spiritual, helping people, computing in society

## I. INTRODUCTION

Computer agents have received significant research attention. The need for agents has expanded as the complexity of computer software, Internet sites, and modern daily living has increased. Computer-human interaction practitioners and cognitive scientists have long considered the creation and use of agents as a potential solution to these complexities. Another significant potential use of agent technology is to understand the personal needs of a user on a deeply psycho-spiritual level. This interaction requires a trust relationship between the user and agent.

The challenge in creating an agent of this type is to provide a system that can learn about a user, adapt to his/her changing needs and contexts, and provide meaningful content from a taxonomy of diverse and complex text and other media. This necessitates the development of a personal agent as a self-contained system that can solve a problem, be reactive or proactive, and exhibit social behavior [1].

For any agent to be successful, it must move beyond simple query to proper interaction in all contexts [2]. This implies an extended level of personal interaction. This project addressed this need first by assembling a diverse team of practitioners and researchers including experts in computer science, computer-human interaction, linguistics, semantics, psychiatric medicine, self-help literature, and content editing.

The development of the Agent architecture, Agent query, content management and user experiences were all coordinated with the need for the Agent to appear personal and caring. A caring agent is essential [2].

The necessity for the agent to fit this profile is driven by the nature of issues that potential users would be exploring. The issue list includes over fifty items in the initial implementation, and there are plans to move to hundreds of specific issues. For example, a user can specify issues such as a loss of a loved one, difficulties with a coworker, ending of a relationship, lack of self-esteem, unhappiness with one's body or appearance, concerns with marriage, and concerns about the environment.

The Agent is told of the user's current issue then uses a combination of the user's profile information containing his/her spiritual tradition and openness to other traditions, the history of the user's previous visits, and the similarity of the user to other users who have rated content. This combination allows an intelligent agent to match useful and meaningful content to a user on an issue-by-issue basis.

This paper starts with a discussion of the Agent architecture and components, an overview of the Agent query system, a detailed discussion of how Agent communications are handled, and a brief discussion of the importance of the user experience. The paper ends with a short discussion of future work and an acknowledgement of support.

## II. USER'S CONTEXT

The user's context is key to creating a meaningful interaction. The Agent must examine the context and determine what information should be presented. The presentation method itself is important because a person in need or crisis can only receive and process information in certain ways. It is not simply an exercise in reading text.

The user's context is dynamic and composed of many parts. Initially, the user's profile and current issue provides the entire context. As the user engages the system more, his/her history is maintained to control recurrence of individual content items. The user's individual rating of content items is also maintained to influence the Agent for future selection of content. Another part of this expanding context for influence on Agent behavior is the tracking of visits to locations within the site and actions the user takes (e.g., selection of an issue). The Agent knows if this is a user's first visit, a second visit, etc. as well as how many times a user has explored a specific issue. This entire context is a key element in the Agent algorithm.

## III. AGENT ARCHITECTURE

The Agent architecture is an integrated system comprised of an immersive user experience, an extensive database of spiritual, psychological, and select modern self-help texts along with thousands of photographic images and audio with an Agent connecting these to the user. First, the user experience provides an immersive system with embedded agent script described below to provide pseudo-conversational interactions. Second, there is a content database organized by a flexible psycho-spiritually oriented taxonomy for classification and identification of content required for the experience. Third, the core agent technology produces multimedia experiences, communicates in a personal manner through a scripting language, and creates personalized sets of content tailored for the user's current need or issue within the user's context.

### A. The Agent Components

The Agent uses a recommendation engine, a learning system, a recurrence engine, a tagged database, user history tracker, and a detailed user profile to create highly customized and personal content. All of these components combine to respond to interactions and requests from the user.

The Wisdom Content DB contains material from five thousand years of the world's wisdom traditions, ranging from ancient scriptures to modern self-help and non-religious content such as rational psychological and secular content. Content items consist of the following types:

- short text items
- longer quotes
- article-length, contemplative texts (e.g., personal essays)
- practices for users to consider (e.g., meditation)
- images
- agent scripts for user interaction
- music and other audio files
- video

The most important aspect of creating the Wisdom Content DB is the tagging of each content item to the psycho-spiritual taxonomy. The Agent uses these tags as part of its filtering process. Tags represent spiritual traditions such as Christianity, Islam, Hinduism, Buddhism as well as secular beliefs. All content items are also tagged as relevant to an issue such as relationship breakup, job loss, death, or depression. The tagging of traditions and issues is not singular. For example, a particular nature image may be tagged for all traditions and multiple issues. There are tags for additional filtering such as gender and humor.
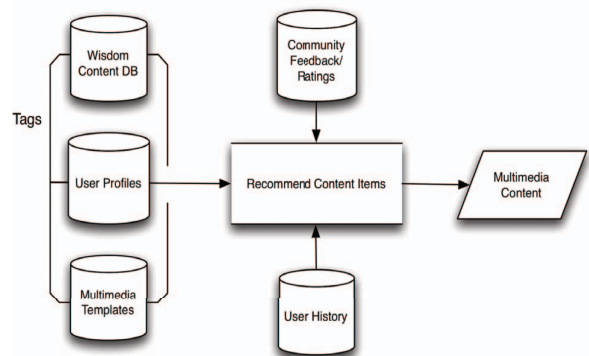


Figure 1. Agent Components

The system uses the Drupal Content Management System (CMS) terms and vocabularies to create its taxonomy for content items. The Agent discovers the definition of each content item through these meta-tags. This allows the instant addition, deletion, or modification of tags. An example of this capability in action was the following discovery during research on the multimedia experience. It was determined that the dominant color of an image was important for smooth transitions between images. Thus, a Dominant Color tag was added.

The user profile database contains user information such as name, nickname for system use, contact information such as email address, preferred spiritual tradition, gender, relationship status, and parental status. Parental status (i.e., does the user have children) is important in determining content for certain issues. The Agent continually learns from the user during subsequent interactions to add to the user profile. For example, the Agent provides a list of photographic images for the user to rate in terms of emotional effect. This information is used to assist in selecting images for multimedia presentation.

Multimedia templates are authored by administrators with experience in filmmaking. These templates provide guidelines for the times and content items in the multimedia experience. The user's history and community ratings are used as a filter to provide final selection of content items. These are discussed in more detail below.

## IV. AGENT QUERY SYSTEM

The Agent query system is the core of the Agent. It is used to find highly personalized and customized content for the user. It does this by identifying similar users and similar content items, and then recommending content items based on a set of feedback scores and filters. The Agent examines ratings of content by similar users in order to anticipate potentially effective content for a given user. Similar items can be recommended to users in a given context, such as recommending a book similar to one that a user had indicated he/she liked when facing a similar issue.

### A. Agent Filters

The Agent employs three primary filters. The first filter is a User Profile Filter (p-filter), which is used to restrict the set of users considered by the

recommendation system. The p-filter is based on fields in the user profile, such as gender, age, and belief system (i.e., spiritual tradition). The user profile of the selected user is used to build the p-filter and the Agent only considers other users who match the p-filter.

The second filter is the Item Tag Filter (t-filter). All items in the Wisdom Content DB are tagged with terms from the taxonomy and applied to items based on content type. Any combination of tags can be used in a t-filter, which will restrict the system to return items that match these tags.

The third filter is the Recurrence Filter (r-filter), which is used to control when an item can be shown to a user. If the user has not seen an item before, then it will pass the r-filter. Once an item has been viewed (i.e., added to a user's history), a recurrence rule determines when it can be seen again, if ever. This rule is defined on an item-by-item basis. The rule can specify that an item can be seen again immediately, can never be seen more than once, or can only be seen again after a specified period of time has passed (e.g., 1 day, 2 weeks, 3 months, etc).
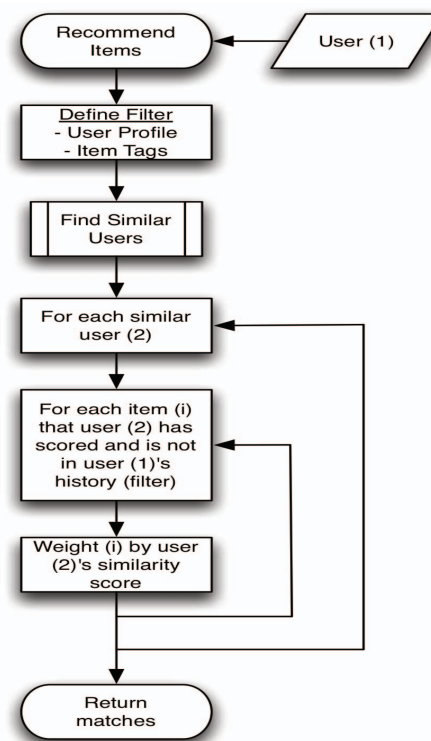


Figure 2. Recommendation Engine Logic Flow

When evaluating whether to show an item to a user, the r-filter checks the recurrence rule for the item and the history table for the user and decides whether to allow or prevent the display of this item.

### 1) Similar Users

Given a user in the system (i.e., the "source" user), the Agent finds other users who are "similar." In this case, "similar" means users who tend to provide feedback scores on items that are the same as the source user's scores for those same items. First, the Agent builds a p-filter for the source user. For each other user in the system that matches the p-filter (i.e., the "target" user), the Agent finds items that both the source and target user have scored, potentially restricting the comparison to items that pass the t-filter. The set of items that have been scored by both source and target users is then used to compute a similarity score $r$ using the Pearson correlation coefficient. If $r$ is greater than the similarity threshold, that user is identified as a similar user. The set of similar users is returned.

### 2) Similar Items

The function used to find similar items is analogous to finding similar users and begins with an item in the system (i.e., the "source" item). For each other item in the system that matches the t-filter (the "target" item), the Agent finds all users who have scored both the source item and the target item. Then it uses the set of users who have scored both source and target items to compute a similarity score $r$ using the Pearson coefficient. If $r$ is greater than the similarity threshold, that item is identified as a similar item. The set of similar items is returned.

### 3) Recommend Items

For a given user (i.e., the "source" user), the Agent attempts to return a set of items that this user will like. It begins by finding similar users to this user using the similar users logic described above. For each similar user (i.e., the "target" user), it finds all items possibly restricted by a t-filter that the target user has scored and are allowed by the r-filter. A ranking is computed using the following formula:

$$s = \frac{\sum rf}{\sum f}$$

where $r$ is the similarity score for the target user, and $f$ is the feedback score given for this item by this user. The ranked items are returned as shown in Fig. 2.

### 4) Pearson Similarity Metric in the Agent Query

The Pearson correlation coefficient is used to compute a similarity score between two sets of data. It is a measure of how well the two sets of data can fit on a straight line.

$$r = \frac{\sum XY - \frac{\sum X \sum Y}{N}}{\sqrt{(\sum X^2 - \frac{(\sum X)^2}{N})(\sum Y^2 - \frac{(\sum Y)^2}{N})}}$$

$X$ and $Y$ are values in an array that refer to the same entity (either a user or an item). $N$ is the number of items in the array.

When finding similar users, the Pearson coefficient uses the array of feedback scores for items given by the source user and each target user as shown in Table 1.

TABLE I.        SOURCE AND TARGET USER FEEDBACK SCORES

|  | item 1 | item 2 | … | item $n$ |
|---|---|---|---|---|
| source user | 4 | 2 | … | 5 |
| target user $_i$ | 3 | 1 | … | 5 |

When finding similar items, an array of feedback scores is created for the source item and target item given by users.

TABLE II.        SIMILAR FEEDBACK SCORES BY USERS

|  | user 1 | user 2 | … | user $n$ |
|---|---|---|---|---|
| source item | 4 | 2 | … | 5 |
| target item $_i$ | 3 | 1 | … | 5 |

The Pearson correlation coefficient is chosen for this application because it is not influenced by grade inflation, where one user consistently scores items higher or lower than other users. Pearson will return a score to a straight line, regardless of the magnitude of the scores [6].

## V.    COMMUNICATIONS WITH THE AGENT

The user is placed in a fine art, immersive environment where the Agent is always present and available for communication. This is critical because of the type of users who visit the site and their potential state of mind. For example, many users will be distressed and dealing with a life event such as a loss of a parent. Virtually all of the content is deeply meaningful and covers sensitive topics. Thus, it is critical that the Agent assumes an appropriate persona for this interaction.

One underlying concern of the ability of the Agent to assume a personal communications role for psycho-spiritual content delivery is one of trust. For users to complete a profile and share personal details and information, including their personal problems and issues, they must believe that the information will be kept private [2]. There are also privacy laws in countries that must be observed [4]. This is accomplished in the system with stringent access controls, security mechanisms, and information control.

There are three methods the Agent uses to communicate to the user. The first is the use of Agent Script (AScript), which displays personalized, context-aware text messages to the user. This is a composition of text content items and contextual information from the user's profile, history, and current state. The second method of communication is the multimedia experience. This is a multimedia movie made from images, music, text quotes of wisdom, and AScript, typically delivered in a 30-second to three minute Adobe Flash movie. The third method of Agent communication is the wisdom set. A wisdom set is a collection of Wisdom Content DB items, which seeks to help the user with her/his current issue. A wisdom set is composed of a multimedia experience, medium length text such as extended quote or sacred text extract, and longer text items such as a personal essay.

### A. User Experience

For a personal agent dealing with a person's psycho-spiritual needs and journey, the user experience is critical. The Agent is not a presenter of information for a passive user to absorb. The Agent is a compiler of information to be transmitted to the user.

### 1) Fine Art Landscapes

One decision made in part based on research was to create a landscape with a symbolic fine art backdrop. Due to the nature of the content and potential user interactions, a digital artist was hired to create a virtual landscape for the experience that could be both soothing and provocative as required.

### 2) Destinations

Destinations in fine art provide a humanized metaphor in which the user is a participant. Water is a constant theme whereby the user looks into water reflections to find interaction interface components. For example, there is a destination called Tradition Bay. By standing in Tradition Bay, a user can look across water and see obelisks of the various traditions represented. For example, an obelisk for Islam would have a crescent, for Christianity a cross, and for Buddhism a lotus flower.

### B. User Interaction

In the user interface there are components for interacting with the system. These interactions consist of navigation (i.e., moving from one symbolic destination to another), viewing of content, purchasing of content, and interacting with the community. All of these activities occur by either mouse or keyboard interaction with the user interface.
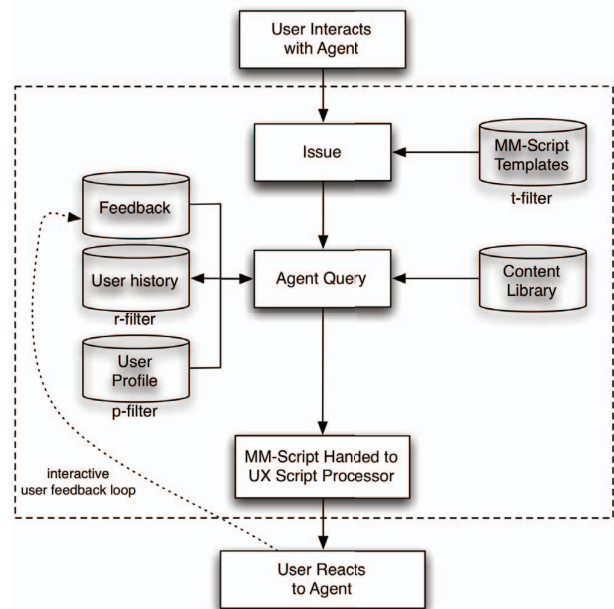


Figure 3.    User Interaction and Agent

Another embedded method of communication is the agent script (AScript) described previously. In one aspect, it is the purpose of AScript to define a personality for the Agent. A personality is defined by its tendencies to present different content items for different user contexts with conversation that appears to give the Agent an emotional status or point of view [5]. Success at humanizing the Agent will assist the user's state (i.e., ability to receive and process) given the sensitive nature of the content and user's state of mind while interacting with the system.

### 1) AScript Example

AScript provides a first person point of view for the Agent and provides a personal touch as part of the overall experience. AScript items are selected using the same method as other content items (i.e., recommendation engine, community ratings, user profile, recurrence, etc).

An example of an AScript content item is shown below with two possible incarnations of the AScript for a user.

Hello <User's Name>. Welcome back to SacredAgent. I see you are dealing with <User's Current Issue> today. I recommend you go to <Location> to see what <Location Source> from <User's Spiritual Tradition> say about <User's Current Issue>.

*Hello <u>Mike</u>. Welcome back to SacredAgent. I see you are dealing with <u>the loss of a parent</u>. I recommend you go to <u>Tradition Bay</u> and see what <u>Christianity</u> says about <u>the loss of a parent</u>.*

*Hello <u>Anne</u>. Welcome back to SacredAgent. I see you are dealing with <u>a breakup</u>. I recommend you go to <u>The Tower of Sages</u> and see what <u>sages from Buddhism</u> say about <u>a breakup</u>.*

The ability to insert this type of data provides a constantly improving personalization as it is expanded. For the case where only a user's name is inserted, there is not as much benefit. However, if the user's name combines with the current issue,

history of the user's interaction, and content from a similar user facing the same issue, the AScript begins to have a conversational aspect. More importantly, a therapeutic conversation (i.e., acknowledgment and attention as key aspects of multiple therapeutic modalities) can occur.

### C. Multimedia Experience (MME)

The multimedia experience (MME) is a movie-like presentation of Wisdom Content DB items created for a user based on their current context. These content items include music and images as a backdrop to create a mood much like a movie experience. Context includes the user's profile (p-filter), the rating of content items, the recurrence engine (r-filter), and the history of the user's interactions with the system (e.g., the number of visits to each location).

One interesting aspect of the research was the need to mimic certain qualities found in motion pictures in order to create the multimedia experiences with high quality and psycho-spiritual usefulness. The creation of an emotional connection in an MME requires the system to provide the Agent with tools that filmmakers use. For example, transitions between images should employ fades, cuts, and dissolves, there should be pans and zooms across photographic imagery, text should fade in and out, and all of the above effects need to be timed with the tempo of the accompanying music. The result of the research is to create an experience that can help the user focus on content delivered by the Agent without being distracted by flaws of the presentation form.

### D. Multimedia (MM) Script

The multimedia script (MM-Script) template shown in Fig. 4 is a script with a timeline for the multimedia movie. It is created from a template based on an issue. The system selects the template and creates the MM-Script by inserting content items from the Wisdom Content DB into each of the placeholders. An administrator familiar with filmmaking techniques typically authors placeholders. The inserted content consists of images, short text quotes, music or audio, and AScript. Content is selected based on many criteria including the ratings of that content item from users with similar profiles as the current user, recurrence (how long ago, if ever, did the user see this item),

how similar is this item to other items the user has previously rated, and how well does the item fit the user's chosen issue and preferred traditions.

The script generation system takes this template and turns it into a fully populated MM-Script. There is a separate track for each type of content item in the template: Audio, Image, Text, AScript, etc. The time row represents the time (start = :00 seconds) where an action starts or ends. There is a total of 65 seconds in this script.

For each content type, there is a template item (denoted by a number) that indicates a position at which a content item must be provided. In this example:

| | |
|---|---|
| :00 - :65 | #1 – Audio item |
| :00 - :35 | #2 – Image item |
| :05 - :30 | #3 – Text item |
| :35 - :65 | #4 – Image item |
| :40 - :60 | #5 – AScript item |

Each template item is a "slot" that must be filled by a content item of the indicated type. In addition, each template item can specify tags that restrict which items can be selected for the slot. These tags are converted into a t-filter for the Agent query.

In addition to the template item type and t-filter tags, each template item can also specify other presentation requirements for the content item. For example, text items and AScript items can specify their font, color, alignment, transitions and effects. It is also typical for audio to play for the entire timeline, and for a combination of images to cover the timeline.

| time | :00 | :05 | | :30 | :35 | :40 | | :60 |
|---|---|---|---|---|---|---|---|---|
| Audio | | | | | 1 | | | |
| Image | | | 2 | | | | 4 | |
| Text | | | 3 | | | | | |
| AScript | | | | | | | 5 | |

Figure 4.   Multimedia Script Timeline Example

## CONCLUSION

This paper has described the creation of a personal agent to help people explore personal life events by providing multimedia presentations and content sets excerpted from a vast collection of wisdom. An agent architecture and query system are discussed which provides highly personalized content to users in need. The critical agent communication implementation is also described along with a brief description of the immersive user experience.

Ultimately, it will be the ability of the Agent to provide psycho-spiritual help in the user's moment of need or exploration that will determine the success of this research and development. At best, the Agent will be able to help users and perhaps provide an evocative collection of wisdom to help in their personal growth. It is, after all, the goal of any personal agent to provide the correct response for the user, even if the user does not immediately recognize which response is the best [4].

## FUTURE WORK

There are several potential areas for additional research. Among the most promising is a predictive analysis of users' unacknowledged issues using psycho-spiritual profile maps produced from past user interactions. The existing Agent similarity logic can be reused here. Users working alone or with psychotherapists could then explore possible connections between their issues using these maps as a starting point.

A technical area for future explorations is for greater automation of the multimedia experience generation. Audio file analysis identifying tempo changes could be used to provide sophisticated, fully automated synchronized transitions of images and text content. Image analysis for dominant color matching can add to the experience by offering homogenous color themes or contrasting themes depending on the target emotional response and concurrent media factors including music tempo changes.

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