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Prediction of User Intentions in Smart Television

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ABSTRACT: Around the world smart TVs are one of the most popular consumer products in every home, and have evolved such that they can now provide personalized and context aware services to users. The existing smart TV's technologies like Electronic Program Guides (EPGs) provide users with program schedules and detailed information that enables them to search for desired programs from among a number of available programs. This technology results in wastage of time for users because they need to search their desirable TV programs which are very cumbersome & also it is not taking into account group of users who needs simultaneous access to the device. So there is a need to develop an efficient smart TV system which provides the user intended services based on context data. In this paper, a simulated context aware smart TV system has been proposed & implemented which is going to predict the user intention & recommend the services based on two parameters i.e. user context history & also other parameters like mood, activity, time, day, role & location.

KEYWORDS: Smart TV, Electronic Program Guide, Context history, Mood, Activity, Time, Day, Role & Location.

I. INTRODUCTION

The availability of artificial intelligence techniques like Fuzzy logic and Neural networks is motivating many researchers across the world to improve the intellectual and social relationship between man and machine. The advancement in pervasive computing, sensors technology and the wide deployment of wireless communication (Bluetooth, Wi-Fi etc.) has resulted in an explosive growth in computing systems and applications that impact all aspects of our life. In every home around the world, smart TVs are one of the most popular consumer products and have evolved such that they can now provide personalized and context aware services to users. Due to their popularity, various technologies have been developed that contribute to making the system even more Intelligent. For example, electronic program guides (EPGs) provide users with program schedules and detailed information that enables them to search for desired programs from among a number of available programs, and the TV Anytime Forum specifies the metadata of smart TV. Consequently, additional technologies and applications have become available for consumers, and systems have become more intelligent by exploiting user information such as profiles, history, feedback, preferred program schedule, and the real-time program information offered by EPG and TV Anytime specifications. However, although these technologies have improved how well smart TV's respond to users? This question can be answered by taking into account group of users who may want simultaneous access to the device, in addition to the above technological achievements. The smart TV (STV) with the development of compression technology and the digitization of TV programs, not only provides high quality audio-visual effects as in high definition TV (HDTV) but also data casting and multimedia interactive services. According to the increasing amount of services provided by the STV, conventional methods of channel selection such as browsing become impractical. The electronic program guide (EPG) can help viewers check future programs in advance. However, the multi-channel STV service delivers more programs than viewers can handle, but results in information overload for users. Thus, the ability of the STV to provide user-personalized services for the individual person automatically is necessarily required. In this paper, the context aware smart TV system has been simulated by taking into account user's contextual parameters like role, time, day, location, mood and activity. The prototype was tested in a living room and the satisfactory results were obtained which shows that the proposed system improves 1) the user's satisfaction level 2) social relationship between TV & user.

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II. RELATED WORK

Over the last decade, most of the research, aimed at predicting the services based on user context. Some of the applications where prediction is used extensively are smart TV, smart car, smart homes, intelligent office, interactive tourist guide, intelligent environment etc. Some of the existing context aware systems are as follows:

Sepideh Chatraveh [1] proposed a prototype called Multimodal Avatar Responsive Live News Caster (MARILYN) for business television (BTV). It uses virtual human avatars for intelligent interaction with smart TVs. It also motivates an analysis of the requirement engineering for IITV and suggests a framework for deploying natural language understanding, speech recognition, and an experience-based approach to decision support for establishing an IITV platform.

Min-Cheol Hwang, Le Thanh Ha [2] proposed an intelligent digital TV (iDTV) that automatically provides user personalized services. By analyzing captured images a real-time person identification system in the iDTV recognizes audiences. As selections associated within a group of users are more complex when compared to selections for a single user, making it more difficult to deliver the best solution in terms of diverse user references and levels of satisfaction.

Yu and Zhou [3] proposed a group recommendation algorithm that merges individual user profiles into a group profile based on the distance minimization algorithm. However, this merging only included individual preferences as group characteristics were omitted in the final recommendations.

Manos Papagelis, Dimitris Plexousakis [4] have done qualitative analysis of user based and item based prediction algorithms for recommendation agents.

Yoon and Woo [5] proposed the universal controller that allows the users to intuitively control a smart TV as a group, but it required users to be actively involved in the control.

Song Jie Gong [6] proposed a collaborative filtering recommendation algorithm based on user clustering and item clustering.

III. DESIGN OF THE PROPOSED SYSTEM

The Proposed architecture of context aware smart TV is shown in Figure 1. The recommendation engine provides the appropriate user intended services based on his context. The user intention is predicted using the algorithms derived making use of Fuzzy logic and Neural Network. The data comprising of activity, location, time, mood & role etc are captured by using different sensors. This combined information is given to the context generator as input, which is going to generate the context as output. This is given as input to the recommendation engine which is going to produce user intended services as output. For example, consider the situation **Father** is **Sitting** on **Sofa** at **5 PM** and is **Happy** watching **TEN SPORTS** channel**.** In the above example, the generated context is **Role:** Father, **Activity:** Sitting, **Location:** Sofa, **Time:** 5 PM, **Mood:** Happy. The channel **TEN SPORTS** is the recommended/ user intended service.

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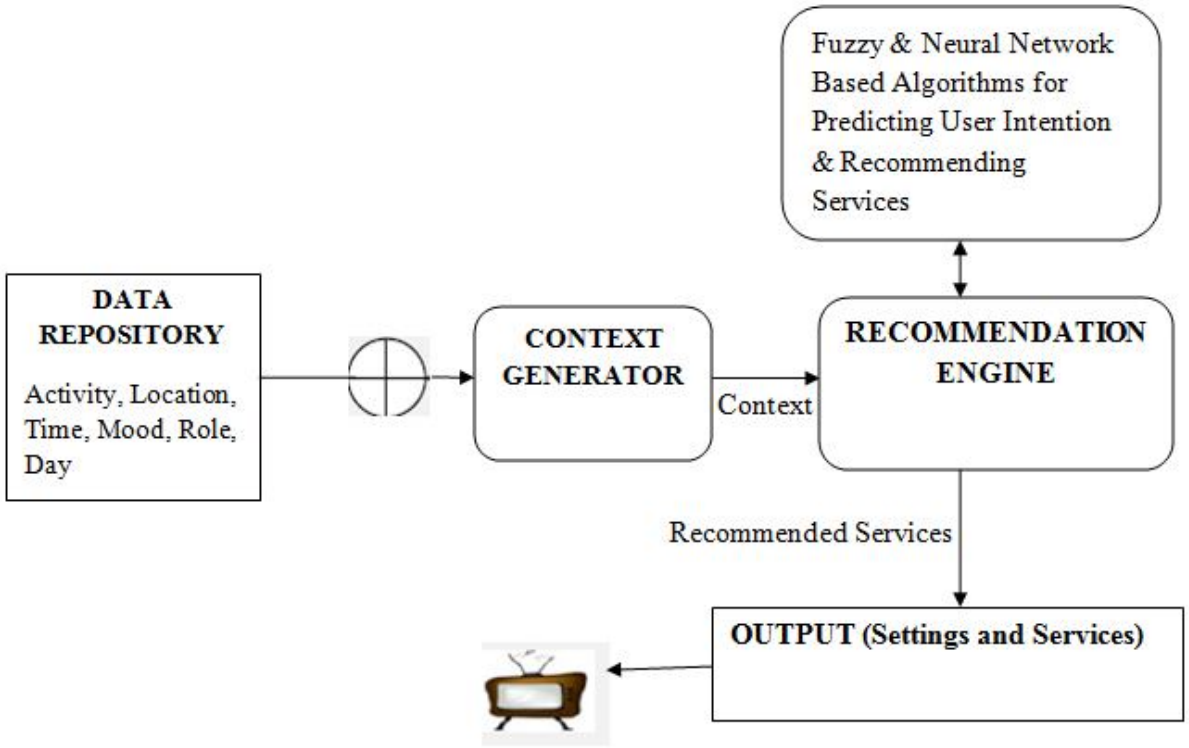

Figure 1: Architecture of the Proposed System

IV. IMPLEMENTATION OF THE PROPOSED SYSTEM

The proposed context aware smart TV is based on Fuzzy logic & Neural network. The steps to be followed in predicting the user intention is illustrated below:

Step1: Read the Context.

Step2: Predict the User Intention.

Step3: Recommend the suitable service to satisfy the user intention and user context.

Step4: Activate the Services.

4.1 Algorithm for Single User Intention Prediction in context aware smart TV

The steps to be followed are as follows:

S1: Input n different primitive contexts.
[Ex: user: father, time: 10 am, activity: sitting, day: monday, mood: good]

S2: Aggregating the primitive contexts to form secondary context.
[Ex: secondary context = {father ∧ time ∧ sitting ∧ monday ∧ good}]

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S3: Associating the semantic to derived secondary context.
[Ex: father is sitting in living room at 10 am]

S4: Output Generated Secondary context.

4.2 Algorithm for Multiple User Intention Prediction in context aware smart TV

The steps to be followed are as follows:

S1: Input n different primitive contexts.
[Ex: user1: father, user2: mother, time: 10 am, activity: sitting, day: Monday, mood: good priority: 1]

S2: Aggregating the primitive contexts to form secondary context focusing mainly on priority of the user. [Ex: secondary context = {father ∧ 10 am ∧ sitting ∧monday ∧ good∧ 1}]

S3: Associating the semantic to derived secondary context.
[Ex: father is sitting in living room at 10 am having priority 1]

S4: Output Generated Secondary context.

4.3 Description of the Platform used

.NET Framework is a software framework developed by Microsoft that runs primarily on Microsoft Windows. It provides language interoperability across several programming languages & also includes a large library. Programs written for .NET Framework execute in software environment known as the Common Language Runtime (CLR), an application virtual machine that provides services such as security, memory management, and exception handling. The class library and the CLR together constitute .NET Framework. .NET Frameworks Framework Class Library provides user interface, data access, database connectivity, cryptography, web development, numeric algorithms, and network communications. Programmers produce software by combining their own source code with .NET Framework and other libraries. .NET Framework is intended to be used by most new applications created for the Windows platform. Microsoft also produces an integrated development environment largely for .NET software called Visual Studio.

4.4 Results

The following results were obtained which shows how the user intentions are predicted in single & multi-user environment.

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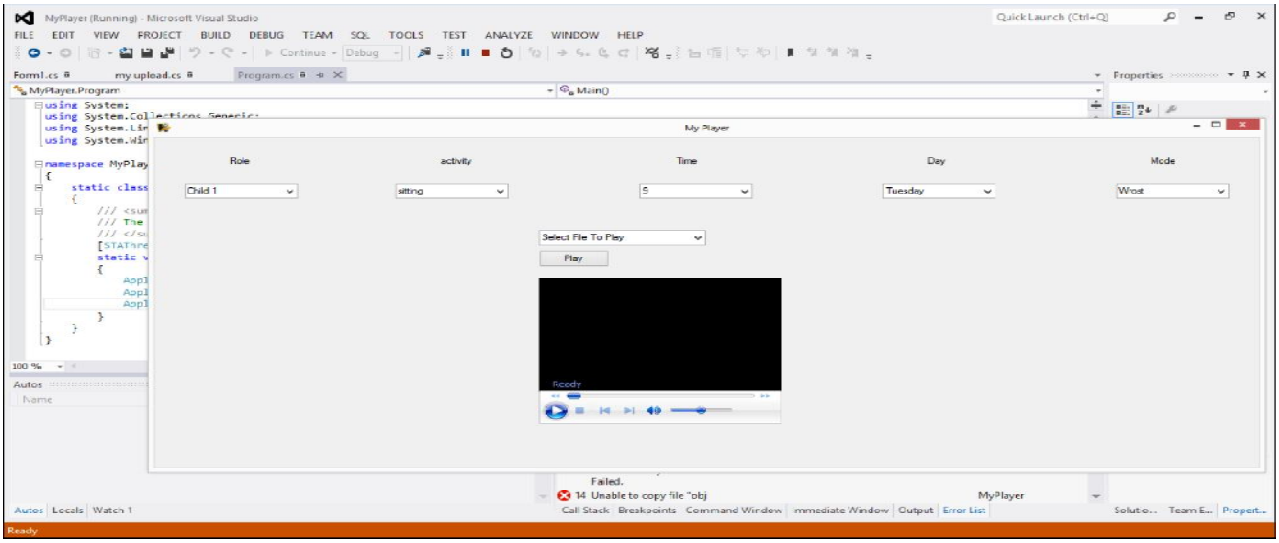

Figure 2: Output design for single user

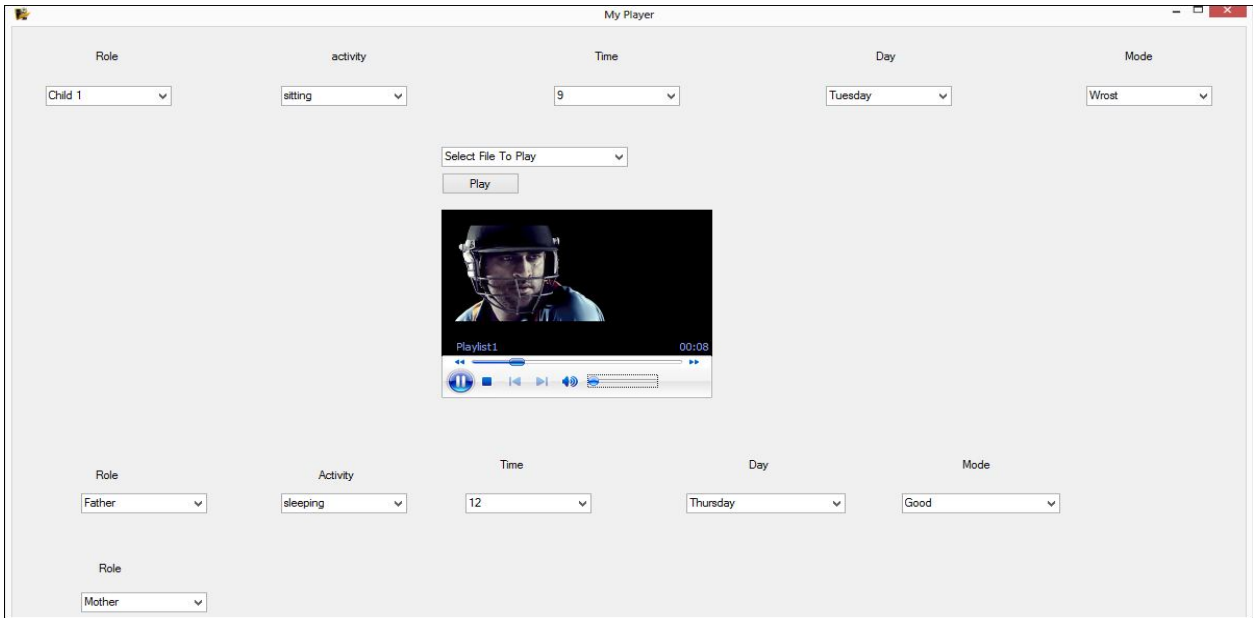

Figure 3: Output design for multiple user's

V. CONCLUSION & FUTURE WORK

The research work presented in this paper proposed the simulated version of context aware smart TV system which predicts the user intended service like TV channel based on contextual information. The contextual parameters considered by the system are role, activity, mood, day, time & location. The proposed system is implemented using .NET platform. The simulated results shows how the proposed system predicts user intention by using context history & other parameters associated with context in both single & multiuser environment. As a future work the smart TV system with implementation of Bluetooth tag or Mobile MAC Address to automatically identify the user when he/she

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enters the living room with the intension of watching television can be designed. Generating contextual conditions at runtime, depending on the different kind of users of the application and mood of the user can also be done.

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