Ofisina : Kinect based Virtual Office Assistant

Ammar Ahmad Awan, Muhammad Aamir Saleem, Sungyoung Lee

Dept. of Computer Engineering, Kyung Hee University, Yongin, South Korea

{ammar, aamir, sylee}@oslab.khu.ac.kr

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Technology is shaping the society in many forms including the use of virtual and digital beings as substitutes to humans. An interesting project called Milo developed at Lionhead Studios envisions a virtual character who entertains its users by playing games and telling stories to them. It is based on Microsoft Kinect device for recognition of facial expressions, body movements and voice. Inspired from Milo, we propose a virtual character called Ofisina who will act as a very useful person in offices, schools and universities. We propose a specific use-case for Ofisina which is its role in a virtual office. Ofisina is capable to do all the tasks which are usually carried out by assistants in an office. Ofisina is capable to manage emails, mobile phone messages, procurement requests and scheduling tasks for its user. We propose this software as a pluggable framework. An important part of Ofisina is also its emotional model. We will use a popular model called Robot Intelligence for Digital Emotion (RIDE) model. The main contribution of this paper is the proposed Virtual character framework based on RIDE model and Kinect.

Keywords: Kinect; Virtual Office; Emotion Recognition; Project Milo

Introduction

We are witnessing a dynamic advancement in technology and the latest foray of technological changes has profound effects on how humans interact with each other and the plethora of machines around them. Technology is shaping the society in many forms including the use of digital beings or robots as substitutes to humans. Digital beings can be mechanical robots, or software agents or virtual characters but their basic intention and purpose remains the same i.e., to interact with humans effectively, efficiently and intelligently.

Robots are very complicated machines that involve inter-disciplinary research for their production. Robotics is a conglomerate of mechanics, computer science, physics, emotional science and many other disciplines. Robots are hard to design and a lot of effort is spent to model them correctly so they have the best possible physical

appearance. Humans only feel comfortable to interact with humans or human-like devices. Classical robotics included just proof of concept robots but with the passage of time robotics has made great progress towards intelligent and user friendly robots. Recently, we have seen robots like Aibo [1] and Paro [2] which are very nice to experience and they are available for regular customers. The only problem with Robots is that a lot of research and development goes into the physical and mechanical characteristics of robots dampening the focus about emotional intelligence.

On the other hand, we have software based agents such as email agents, short messaging service (sms) applications or even virtual characters. These can be modeled and created using advanced software techniques for facial design, character design and physics modeling. These software based characters have been used in video games but they do not interact closely with the players of the game. In video games, characters are inside the game only and we don't feel a connection with them. Recent efforts like Project Milo [3] from Lionhead Studios [4] have described their proof of concept. They show that a virtual character can actually interact with humans in an immersive and active manner. The main focus is that the user should feel a strong connection between themselves and the character.

Technology Background

Kinect for Xbox 360 or simply Kinect which was originally known by the codename Project Natal is a motion sensing input device by Microsoft for the Xbox 360 video game console. Kinect can do a lot of magic for the game developers to build immersive body controlled games like Kinectimals [5] and Kinect Sports [6]. Some of the key technological aspects include motion sensor, skeletal tracking, facial and voice recognition. Lionhead studios are the developer of the famous game series called Fable and they announced Project Milo back in 2009 at E3. It is still a technical demo even

after years of research and development work. Milo is a virtual character; an eight year old boy who seems like a real life character. He can talk to you like your friend; can recognize your voice, your face and your tone even. He can recognize different colors and shapes and can learn from your actions. He shows gestures and different moods. You can hand over a piece of paper to him, cheer him up, and help do his homework even. A collection of technologies like Hand-writing recognition, Facial recognition, Motion recognition, Voice recognition and Cloud computing helped in the development of this project. Milo is a project geared towards entertainment and games; we think a lot of upcoming games will benefit from the foundations of technological advancement laid by Project Milo. Inspired from Milo, we propose a virtual character named Ofisina who will interact with people in an office.

Ofisina will also require an emotion model which is pertinent for its efficient functionality and interactive usage. Robot Intelligence for Emotional Intelligence (RIDE) model will be applied in Ofisina for detection of emotions of its user. RIDE model is based on oriental philosophy and covers seven feelings that include happiness, anger, sadness, joy, love, hate and desire. Desire is further divided into five types that are Eat, Sex, Sleep, Money and Power. RIDE emotional model is composed of a Desire vector and a Reaction database. Here desire vector covers the desires of the user for food, sleep etc. and on basis of current status of that desire a value is assigned to that desire. Range of this value is from (-100) to (+100). It has three thresholds which separate its range value into four parts of Very bad, Bad, Good and Very good. Initially its value is 0 but as something happens and user gets influenced by some external stimuli its value gets updated. Updated value is given by following formula.

$$\text{Current Feeling: } E(t1) = E(t0) + E(s) + \sum D(s) \text{ ---- (1)}$$

Where, E(t1) : emotion at t1

E(s) : Stimulus from out side

D(s) : Desire vector triggered by s

After getting value from above formula it is compared with the reaction database and an action corresponding to that value is performed. We explain this with the help of an example where we receive an email and it renders a change in our emotion. The value of the new emotion will be given by formula (1). For example it gives us a value of -60. We check for the corresponding action of this value in our reaction database. The action for -60 is to block the sender of such email. Ofisina will block the sender of this email.

Design of Ofisina using RIDE model

Our motivation is to create a human-like digital being, which can learn over the period of time, who can remind you about your daily tasks and who can do almost all of the things that human assistants do. Some of its applications are

(1) Ambient Assisted Living for Elderly people
(2) Hospitals – Patient care and psychotherapy
(3) Schools – Virtual Tutors

Ofisina is the character we envision for this purpose. It will use the RIDE [7] emotional model and Kinect sensors. The framework will have following modules.

(1) Email module
(2) Message module
(3) Procurement module
(4) Schedule module
(5) Postal Mail /Letters module

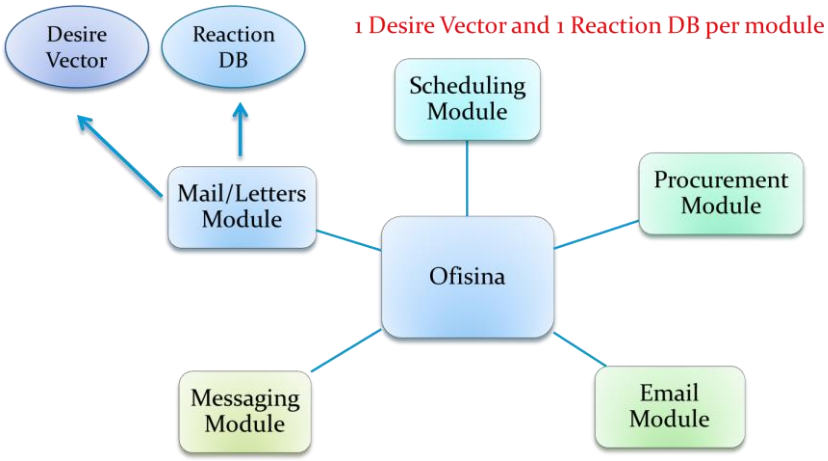


Fig 1: Architecture Diagram of Ofisina

Email Module:

As discussed earlier that we are using RIDE model for Ofisina so each of these output modules will be based on Desire vector and Reaction Database which are components of RIDE model. Emails are the most common communication source now days and so this module is designed for tracking of user's email. This module will learn itself with passage of time like if user reacts angrily after getting an email from a particular user this module will block that user or may be assign low priority to that guy's email, Action depends on desire vector and reaction database of user. In simple words we can say that it will keep record of all the expressions of user during reading email and on basis of this it will learn and eventually it will be able to reply by itself. Desire vector of email module will have name and value of email contacts. Greater value will depict more importance and vice versa. Desire Vector table having example value is given below.

Desire	Value
Kim	40
Ammar	10
John	-20
.	.
.	.
Other Contacts	.

In the picture above, “Kim” has value of 40 which is highest in this particular example. So for user who owns this email module desire vector, Kim will be most important person and John will be least important person as he has lowest value. Reaction database stores information of action which is to be performed after getting influenced by some external stimuli. Example Reaction DB is given below

Very bad	Bad	Good	Very Good
-60 Block Sender	-20 Don't reply email	30 Reply Email quickly	70 Send thank you message
-50 Send Warning Email	-35 Remove from Contacts	50 Send a greeting message	80 Instantly reply via SMS
.	.	.	100 Send a gift to sender
.	.	.	.
.	.	.	.
.	.	.	.

In the picture above, it is shown that in worst case it will block sender for future. And in best case it will send gift to sender of email. Some other example scenario can be seen in this picture.

Procurement Module:

As we are also targeting an office assistant and one of the important jobs from office perspective is taking care of procurements. We embedded this facility in our project. This module will replace a guy from office whose duty was dealing with procurement. It will be mature enough to deal with almost all kind of scenarios related to buying or replacing of new items. Example of desire vector for procurement module is given

below.

Desire	Value
Client payment	70
High Official order	50
Staff Order	20
Television in Office	-20
.	.
.	.

In picture above, left side has some tasks and on right side their value is given. Same is the case for this module, task having higher value is more important. Reaction database of this module contains actions for procurement module. Example is given below.

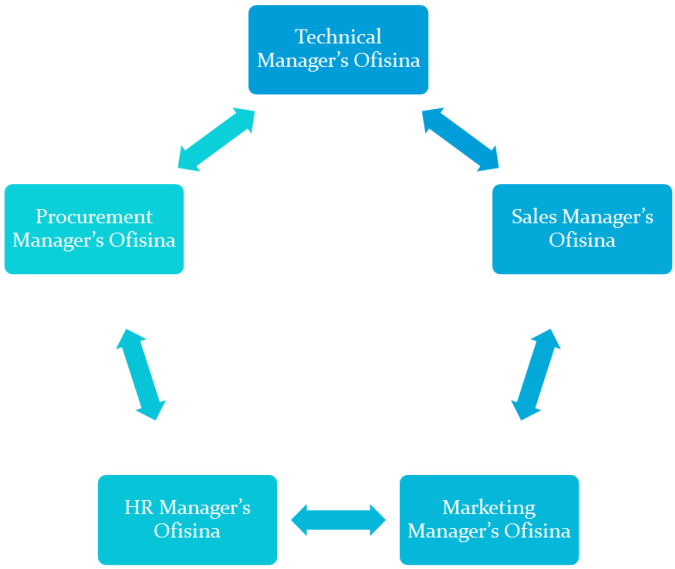
Very bad	Bad	Good	Very Good
-60 Send warning for this kind of order	-20 Assign low priority	30 Add this in order list	70 order Now
-50 ignore this kind of order for next time	-35 do not order	50 assign priority	80 Urgent order placement
.	.	.	
.	.	.	.
.	.	.	.

In picture above, some actions corresponding to their values are shown e.g. on value of 80 this module will order items on urgent basis.

Other Modules:

Other modules are not discussed in detail here but they follow a similar pattern including 1 desire vector and 1 reaction database per module. We envision that Ofisina will be very useful as it will allow interaction among multiple instances of Ofisina. The picture below shows a scenario of how Ofisina(s) can be used in an office where multiple mangagers have their own Offisina assistant and they can freely interact with other assistants in the office. The protocol of this communication will be based on Web

services which will allow easy inter-operability.



Conclusion

We proposed a novel framework in this paper which can be implemented by using Kinect device, its SDK and RIDE model. We believe that once the Kinect or similar devices become easily and affordably available, this kind of technology will be really helpful in offices, schools, hospitals and other institutions. We are working on the prototype implementation in the current phase and we strongly believe that this will open the doors to a new era of automation in human centric environments like offices, schools and hospitals.

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