

# Smart Team Management System

ATIA AYMAN YU SUZUKI, SEO SEWANG , GAO JIE, KOBAYASHI  
ATSUTOMO  
ADVISOR PROF. JIRO TANAKA †<sup>1</sup>

Smart Team Management System (STMS) is a ubiquitous based system that support and facilitate work between team members, in order to have a fully utilized working environment. STMS can be adapted and customized to be used by different types of teams. This system will provide transparent monitor of team activities and can be used as a decision support system for pushing the team members towards achieving their tasks more efficient and more utilized. We presented three main modules for supporting team activities: first a core module for monitoring the team day to day activities deadlines, delayed and assigned tasks. Second Ubiquitous task which is a module that support the transferring of tasks to users depending on the context of their locations. Third is a career advisory tool that can guide the team member through there practical career objectives. We presented these three modules as a sample of what Smart team management system can do to support teamwork within groups.

## 1. Introduction

Teamwork is the concept of people working together cooperatively, there exist many commercial market tools that dedicated to project management in general. They do support for users' interaction with the system. Our main goal is to have a smart team management suite that can ubiquitously support cooperative work between team members. It has been noticed from 1)–5) that those systems are dedicated to programmers and software developers as they provide bug tracking and version control. In our system, we focus on how to utilize all the resources of organization to achieve team tasks. The developed system can be adapted to any shape of groups that share collaborative work. One of the main problems that can face group ware systems is the lake of awareness to context the user needs according to different situations or context. In this sense we try to develop a system to target area by providing to users an aware tool that can support day to day activities we call this tool Ubiquitous Task. Another problem that was noticed in most of team management systems is the lake of direct support users' future practical career plans. In this means we developed a second module that focus on how to support the users future career targets by evaluating their current activities performance. The rest of this paper is divided as

follows section 2 reviews the related literature work. In section 3, the overview of the proposed system is introduced. Section 4 present details of the proposed prototype system. In section 5 we present discussion and future work.

## 2. Related work

Bardram<sup>6)</sup> shows Activity-based computing which enable multiple users to share activities, which are composed of multiple tasks. Their work mainly focused on sharing tasks. On the other hand, our system mainly focuses on monitoring tasks and users' activities for better decision making. Also, in Activity-based computing, another main purpose is task transfer between several kind of devices in ubiquitous environment. On the other hand, our system aims to obtain and utilize context information of users from ubiquitous environment.

As evaluation system of personal history, Schild<sup>7)</sup> developed evaluation system of offender's previous record for judges. This system implemented with knowledge-based system in rule-form and inputting data to a database is done manually. In our career advisory tool, system administrator can make various career path by making appropriate settings. Therefor our career advisory tool is not restricted in a particular domain. About inputting the data, STMS automatically gathers the data from team members' day to day activities.

## 3. System Overview

Smart Team management system (STMS) is

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†<sup>1</sup> Tsukuba University, Department of computer science, Interactive proگرامing laboratory IPLAB

a task oriented system which means that the task is the core point of all modules that will operate the system, hence we will start by describing the main features and function of the STMS. Task is the basic unit of our system. Tasks is the unit core for the operations done by users. An example of such tasks could be visiting customer, doing some programming code on computer, or doing some charts or even more complex task could be composed from different subtasks. STMS is web based /desktop and mobile software solution for managing work and communication through projects in any field. Not only supporting projects, but the system supports the day to day activities for team members by allowing them to track their performance and skills. The main operators of the system are General Administrator (GA), Team Leader (TL) and Team Member (TM), where every operator has some role for operating the system. **Figure 1** Shows the STMS data flow diagram.

Administrator's main role is concerning the general maintenance of system common and fixed properties. An example for such role is management of teams, Inventory (Hardware, software, installation locations ..etc), giving team members permissions to access computers overall the system.

Team leader is responsible for creating and managing tasks, assigning tasks to team members, view all team tasks, view reports, evaluate each team member skills.

Team member is the main user of the system his main role is to open tasks, close tasks , view task details, evaluate his skills and decide his own career objectives.

The main system composed of task basic functions such as task tracking, alarm system, Task logs and history viewer, these information is stored inside data repository for later retrieval. In the designing of the system core we try to make a generic definitions for task deadlines , log files.. etc so that whenever we need to add some new module to the STMS it can be easily plugged. an example of such kind of pluggable modules are as follows

Assistant Tool is a module that inspires the collaborative work inside the teamwork by al-

lowing more than one team member to share one task and work in it either physically or remotely. Moreover, STMS takes the role of smart task distributor by using the heuristics and experiences of team members to fit the best task distribution of tasks over team members.

Utilization Agent is smart software which is running silently in team members personal computers. This system main functionality is to monitor and track users activities. The system tries to capture users real working time and how much resources used by them for example CPU usage, Internet browsing usage waste time. This system can provide team leaders a real image on team members real performance and resources utilization.

In this paper we presented two plugged modules we call them "Ubiquitous task" and "Career path advisor"

### 3.1 Ubiquitous Task

Any task should have a context according to its locations Each task can have one or more context related to a geographical location. In our research, we target the location context with relation to task type. A typical scenario which can show how a task can be bounded to its context is a sales man scenario. He/she is going to work on the morning then he went to train station and whenever he bypass some information kiosk. A message alarms the sales man that he has some task assigned by his team leader (Manager). **Figure 2** Shows the ubiquitous task sales man scenario.

He/she needs to check the details of this task within his current location. The team member (sales man) will notice that his manager has assigned to him a task to visit some customer before coming to work. In this case, the team member will open the task, read it's details, know the exact address of customer, what he should sell and ..etc, then he/she starts executing this task. Whenever the sales man arrive to the customer office ubiquitously an alarm will be send to him to give him more details about this customer requirements and previous history of visits and any other details needed. Another scenario is a forth grade student who went to his laboratory whenever he enter his laboratory room his computer will automatically shows to him his academic advisor Java coding task (the academic advisor here will act as team leader). The student will open the task

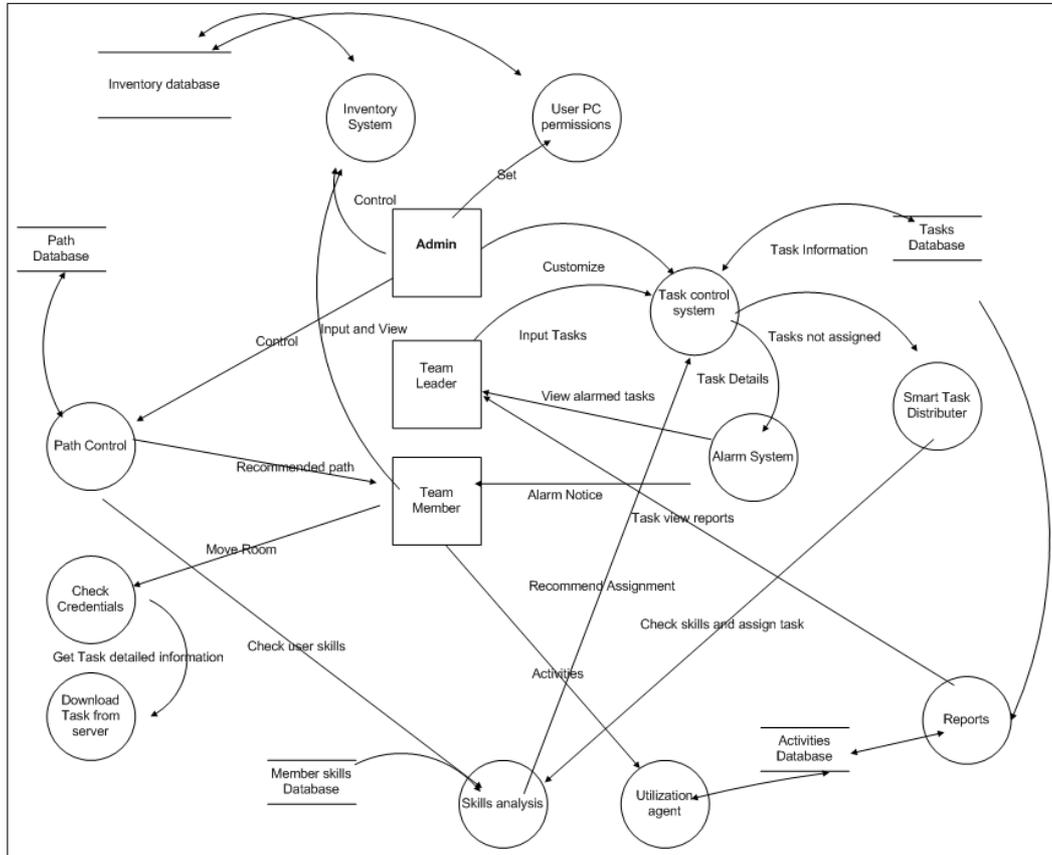


Fig. 1 STMS Data Flow Diagram

and start writing his code. The student has a database programming class that starts at 11:00 am he went to the class room, whenever he enters the room all his previous home works will be displayed on his notebook with due dates. The academic advisor of the class can monitor and trace the assignments (tasks) and detect which students are most active and which students are lazy. Tolia, et al<sup>8)</sup> show that thin client systems, such as VNC, are enough practical solution for ubiquitous portable programs. Thin client systems will gives geographical free to team members.

### 3.2 Career Path Advisor

Career Path Advisor is a tool that uses the heuristics of team members in executing their tasks to advise them about their careers. It combines many parameters like deadlines, real skills, expected targets and etc. It tries to map these parameters into career paths that are pre-defined by professionals. As in Japanese industry it has been noticed that there are some organizations that try to put some standards for ca-

reer pre-requisites for example IPA japan tries to formulate skill standards for IT professionals.\*2. STMS administrator will have to feed the system initially by a graph of career objectives pre-requisites skills. This graph can have any shape either tree or regular graph. Team member can then choose his target careers. STMS will advise him on which steps for his skills he must take or enhance in order to achieve this career target. Returning back to the sales man scenario, this sales man global objective career is to be a marketing manger. To achieve this goal Team administrator have to feed the STMS with paths for the career Marketing manager. **Figure 3** shows the available career paths to be a marketing manager for sales man.

The STMS will run a best fit algorithm with combining different evaluation methods for the Team member, in order to select him the most

\*2 Information-technology Promotion Agency, Japan <http://www.ipa.go.jp>

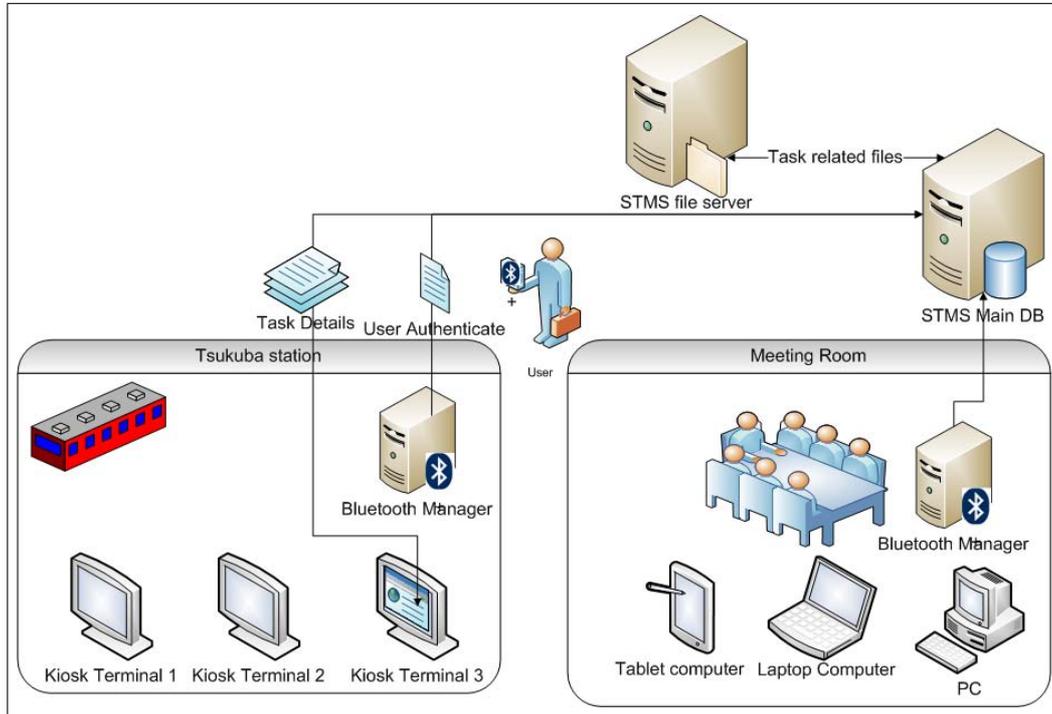


Fig. 2 Ubiquitous Task sales man scenario

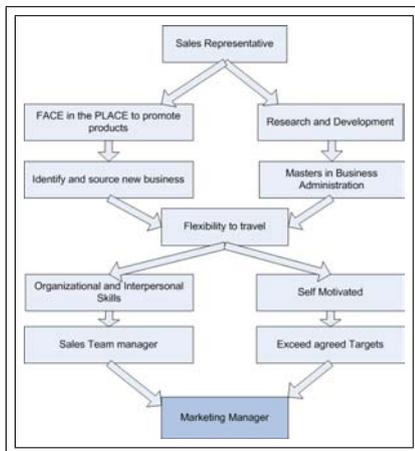


Fig. 3 Career paths for being a marketing manager

suitable path that match his expected and real skills evaluation.

#### 4. STMS prototype

STMS is task based system, any task should have initial date and expected closing date, if the closing date has expired then task should be marked as delayed task. Using the proposed Data Flow diagram in Figure 1 we presented an entity relation diagram ERD. See Figure 4.

The main entity in the ERD is the Task, TM-

SUser and activity/task Log. In this system we introduce generic design for allowing the integration of other modules in future work. Hence we need to monitor different activities for the user like when STMS sent an alarm emails for expired task deadlines to team members. Also STMS have to record all task activates and status with time stamps. Table 1 shows a summary of activity types that STMS records. STMS have to allow the GA to monitor the system resources (hardware , software , locations and ..etc).

Figure 5 shows some core system user interfaces for team members.

#### 4.1 Ubiquitous task

Ubiquitous task module has to know some knowledge about the environment context in order to retrieve accurately the relevant tasks. Hence the general administrator have set some privileges to customize and manipulate the modules related to ubiquitous task.

Team leader can add, edit, delete tasks and assign them to his/her team members. All tasks have task type. Each task types have context of location. For example, in Figure 6, A task which have the task type "MySQL Coding" has to be worked at the office, while a task which has the task type "Visit Customer" has to be

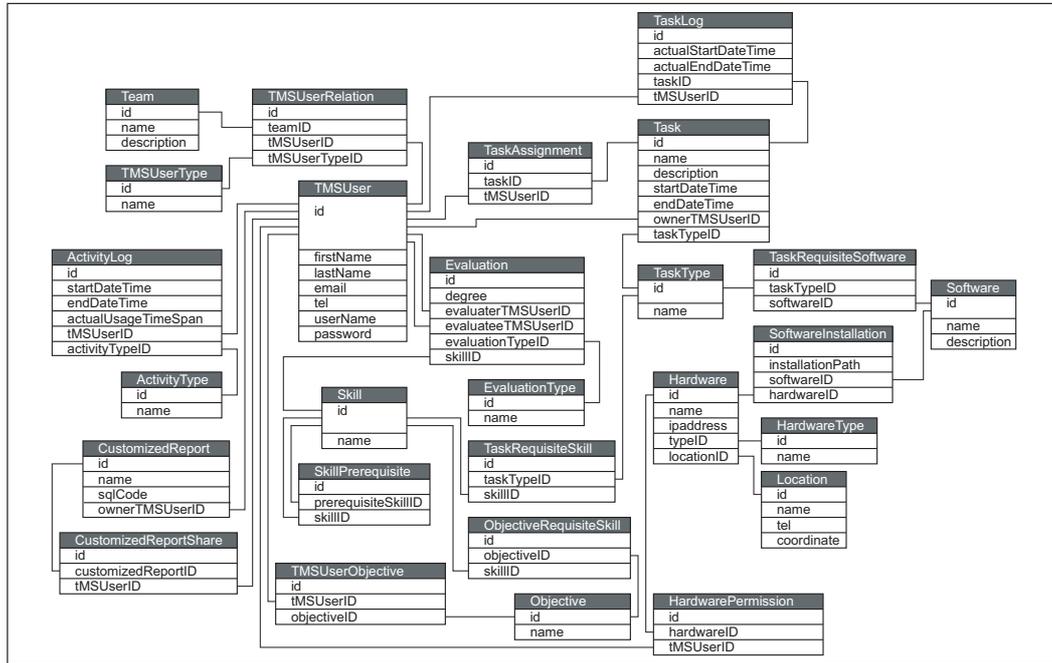


Fig. 4 STMS entity relation diagram

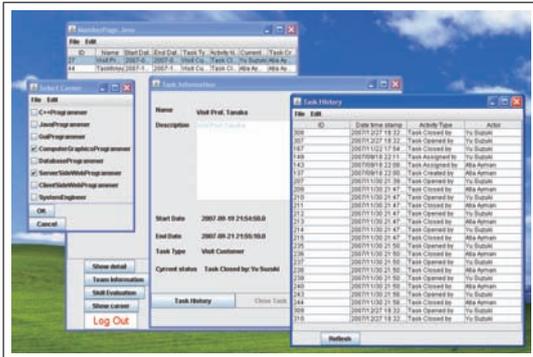


Fig. 5 Objective career selecting window, Assigned task list window(or top page for a team member), Task detail window and Task history window from left to right.

checked outside.

GA have to decide which TM have the privileges of using which machine in what locations. Also he have to fix Bluetooth manager access points that will be responsible for identifying the users in each location. In this research we use Bluetooth technology, because it is embedded in most of the portable devices which can be available for everyone. Additionally, its limited coverage area can allow STMS identifying TM within limited space locations, i.e office rooms, public kiosks ..etc. Ubiquitous task assume the presence of a Bluetooth manager

server on each location that will be responsible of identifying TM. The GA can set which software exist on each resource so that can be related to task types. GA is capable of manipulating the task types and assigns for each task type a set of locations assigned to it. As an example, GA must set the visiting customer task type is as related to outdoor locations, like train stations, bus stations or public kiosks.

Bluetooth manager is a server that is scanning for Bluetooth identification every 5 seconds. If a user exist in the area of the Bluetooth manger approximately about 10 meters. It will automatically trigger an activity type of resource caught. This means a flag for all the resources that are permitted to be used by the TM existed to start showing the identity of the current user. However it exists that some time a user is permitted to user one or more resource in the same location, in this case all available resources will display the identity of the user and wait till user starts entering his credentials and uses any of the resources.

Whenever the user uses any of the resources, a lock flag is assigned so that no other users can use the same resource in the same time. On each resource, there exists an agent application that is responsible for monitoring the activity of the logged in TM. The Bluetooth manager will notify the application agent, whenever

**Table 1** Activity types STMS can monitor

Task activity type	Explanation
Help	TM request help from another TM to accomplish task
Task Created by	TL identity
Task Opened by	Triggered whenever TM viewed the task details
Task Assigned to	TL assign task to one or multiple TM
Send Email	Triggered when STMS sends alarm to user about expired task deadline
Task Reassigned to	Fired by TL whenever he changed the TM author of the task
Task Closed by	Triggered whenever TM closed the task
Resource Open to	STMS record whenever some resource start being used
Resource Close	STMS record whenever resource being released
Task Reassigned by	STMS Rerecord TL identity whenever he changed the TM author of the task
Task Assigned by to	STMS Rerecord TL identity whenever he assign it to TM
Resource Caught	Blue Tooth manager fire whenever TM is presented in a permitted area to use a resource
Resource Released	Blue Tooth manager fire whenever TM left a permitted area of using a resource
Resource Unlocked	Blue Tooth manager fire whenever TM logout from using a permitted resource
Resource Locked	Blue Tooth manager fire whenever TM starts using a permitted resource

the TM release the resource, then the application agent is responsible for unlocking back the resource. The application monitor the TM actual involvement on doing task and monitor how much time the TM wastes time doing other activities rather than doing his task. In our prototype system, recording of waste time is still not implemented.

#### 4.2 Career Path Advisory

In the initial state of the STMS, the GA has to define a set of career paths. A career path is defined by tree of prerequisite skills and a career objective.

There are two kinds of nodes in a career path graph. One represents skill, and another represents career objective. Career objective is always the final destination for a skills path. Arrows means that node (skill) is required for the directed node (skill or career objective). Hence, arrows show the prerequisite path for a certain career objective. Each career objective can

ID	Name	Start Date Time	End Date Time	Task Type Name
...	Visit Bigban Co.	2007-11-01 12:00:00.0	2007-11-01 12:00:00.0	Visit Customer
...	Code serch SQL	2007-11-05 17:40:22.0	2007-11-06 17:40:30.0	MySQLCoding
...	Code customer Servlet	2007-11-05 17:39:20.0	2007-11-26 17:39:27.0	JspAndServletCoding
...	Code website interface JSP	2007-11-28 17:37:09.0	2007-11-28 17:37:20.0	JspAndServletCoding
...	Code customer table SQL	2007-12-27 15:53:58.0	2007-12-27 15:53:58.0	MySQLCoding
...	P.O. for Bigban Co.	2004-03-01 09:53:19.0	2005-03-15 10:01:19.0	Prepare Purchase Order
...	Code sort SQL	2007-12-01 00:08:49.0	2007-12-26 00:08:49.0	MySQLCoding
...	Code adding new customer SQL	2007-12-01 00:08:49.0	2007-12-26 00:08:49.0	MySQLCoding
...	P.O. for Prof. Tanaka	2007-09-19 21:59:29.0	2007-09-21 21:59:33.0	Prepare Purchase Order
...	Call Company A	2007-09-19 21:57:32.0	2007-09-21 21:57:37.0	Call Customer
...	Visit Prof. Tanaka	2007-09-19 21:54:50.0	2007-09-21 21:55:10.0	Visit Customer
...	Code select high dollar SQL	2007-12-01 00:08:49.0	2007-12-26 00:08:49.0	MySQLCoding
...	Code sort by spent SQL	2007-12-27 18:39:31.0	2007-12-27 18:39:31.0	MySQLCoding
...	Code product table SQL	2007-12-01 00:08:49.0	2007-12-26 00:08:49.0	MySQLCoding
...	Visit Mr Suzuki	2007-10-06 00:38:05.0	2008-01-02 00:38:05.0	Visit Customer

**Fig. 6** Task management window for a team leader.

have multiple skill paths leading to it.

STMS has to evaluate team members' skills so that it can advise the team members about their future careers. Each node (skill) will have an evaluation value for each member. There are three evaluation types: Self (SE), Leader (LE) and System evaluation (SYE). The advised career is a total maximum degree for all the above evaluations. Self evaluation means that team member is expecting his skill evaluation in a grade between zero and 100. And the member can change this grade anytime she/he wants. Member evaluation requires the team members to be very honest in evaluating themselves. Leader evaluation is an evaluation done by a team leader. **Figure 7** shows that a team leader evaluating a team member. There can be several leader evaluations since a member can appear in several teams. Hence, an average evaluation value is used as total leader evaluation.

System evaluation is an evaluation done by the STMS after a task is being closed. STMS measure how was the performance of the user towards the tasks in means of time units. The early the user close the task before its deadline the much points the STMS gave to user evaluation and vise versa in the case task closed after its expected deadline. System evaluation can evaluate user on a scale of 100 positive points and infinity negative points according to team member performance.

An example of how system evaluation is calculated

$$Percentage = \frac{Actualtime}{Estimatedtime}. \quad (1)$$



Fig. 7 A team leader evaluating a team member.

$$Evaluation = 300 - P * 200 \quad (2)$$

Multiple tasks are assigned to each member during his work under a team, each task assigned has some skills, so there can be several system evaluations for a member gathered from his skill evaluation within different tasks. **Table 2** shows an example of different evaluation types.

Table 2 STMS evaluation method

Team Member 1	
C++ Skill	
Evaluator type	Evaluator grade
Self	50
Team Leader 1	60
Team Leader 2	75
System Evaluation for task 1	20
System Evaluation for task 2	50

Each evaluation type has an impact factor according to its priority. If STMS trust leaders more than System and System more than Member themselves, assigned rates would be,  
 Self impact factor = 1 ..... S1  
 System impact factor= 2 ..... S2  
 Leader impact factor= 3 ..... S3

Those constant values can be changed and edited by the main STMS administrator.

STMS can calculate total evaluation (TE) for the team member skill as

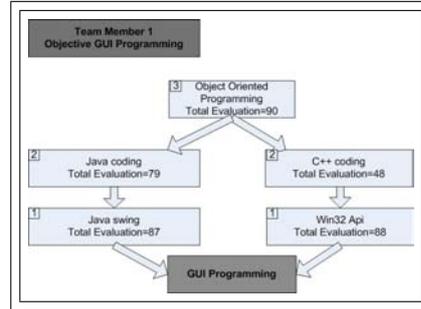


Fig. 8 Step 1:Career paths skill evaluation

$$TE = \frac{SES1 + \sum_{i=1}^N SYE(i)S2 + \sum_{j=1}^M LE(j)S3}{S1 + SYEN + LEM} \quad (3)$$

For example, the TE of C++ skill for team member 1 would be,  $((50 \times 1) + (60 \times 2) + (75 \times 2) + (20 \times 3) + (50 \times 3)) / (1 + (2 \times 2) + (3 \times 2)) = 530/11 = 48.18$

STMS will build a career path with total evaluation for each skill. **Figure 8** shows STMS evaluation for each skill. STMS will consider team member predefined preferred career we call this factor RequirementImportance. Also STMS define a threshold minimum value for each career objective where STMS can select path as an advice for team member, we call this value ObjectiveThreshold.

Assume RequirementImportance (RI) = 0.6 and ObjectiveThreshold =80% Each arrow make importance ratios from RequirementImportance. As the example above, there are six arrows, so there are six importance ratios. STMS will multiply the weight of the depth between the career objective and the skill with the requirement importance value. **Figure 9** shows the depth weight between the career objective and each skill at the top left corner of each skill.

STMS will calculate the total score for each career TCS as

$$TSC = \frac{\sum_{i=1}^N RI * i * TE(i)}{\sum_{i=1}^N RI * i} \quad (4)$$

According to each career objective TSC, STMS will accept the TSC greater than the ObjectiveThreshold values and order them descending for advising the user about his future steps.

**Figure 10** Shows the Career path window for a team member.

Each cells at the most left are objective ca-

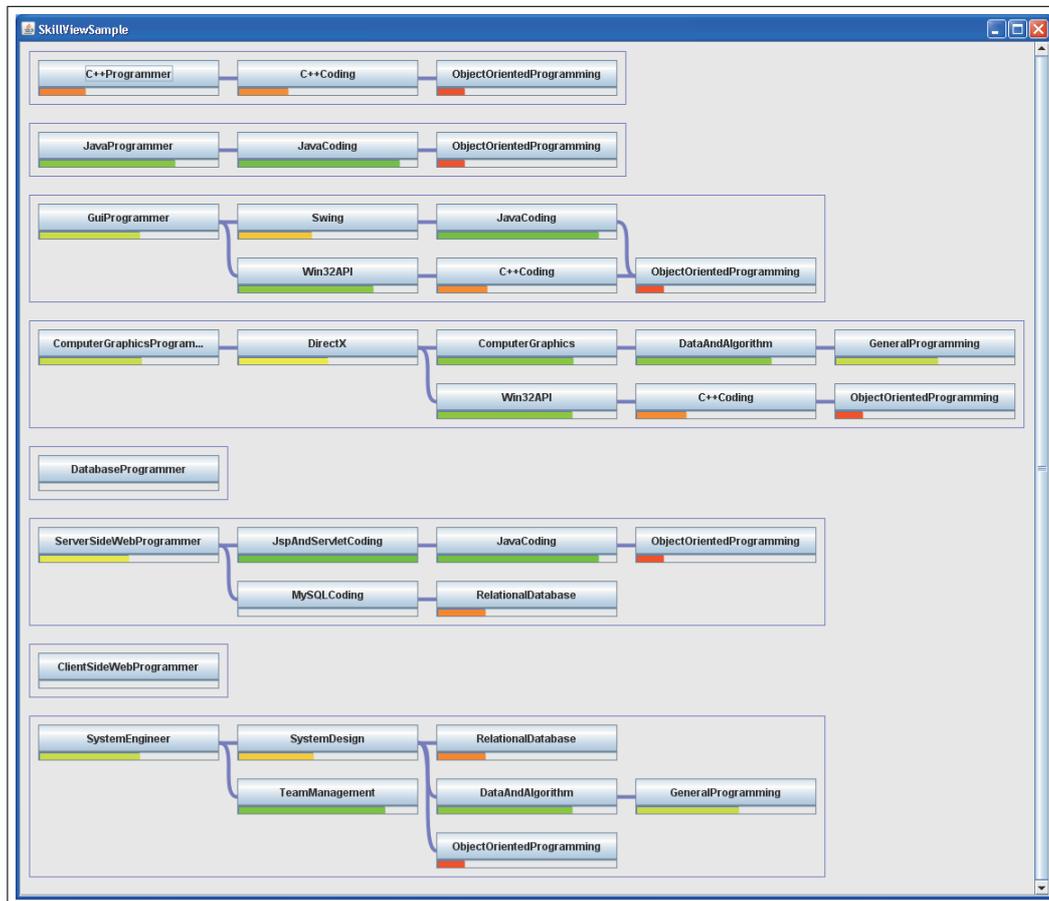


Fig. 10 Career path window for a team member.

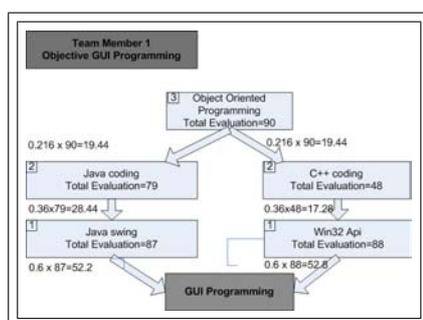


Fig. 9 Step 2 :Career paths skill evaluation

reers and the other cells show skills. The blue lines mean the right side skills are needed for the left side skills or the objective careers. The bars under skill cells show the evaluation for the team member. The bars under objective career cells show achievement for each objective careers. These achievement values are calculated from the evaluations of skills which are reachable to the objective careers. In this case,the

user can see that he/she need to improve the skill "MySQL Coding" or the skill "Relational Database" for the career "Server Side Web Programmer"

## 5. Discussion and future work

In this paper we proposed a prototype nucleus system for group ware and team work ubiquitous environment. The system was designed to be integrated with a set of modules that can facilitate the utilization of resources inside the team and facilitate working environment. We presented three main modules for supporting team activities: first a core module for monitoring the team day to day activities. Second Ubiquitous task which is a module that support the transferring of tasks to users depending on the context of their locations. Third is a career advisory tool that can guide team member through there practical career objectives. We think that our future work should be focusing on how to to expand some

other modules that can support more ubiquitous interactive support for team members. we also need to evaluate the usability of the system in practical life with the impact of monitoring team members activities on their real life performance. Customer satisfaction of the quality of doing his task also must be considered more carefully in deciding the evaluation for the skills of team members for better career advice selection. We have to enhance more functions of STMS by adding other modules like Assistant Tool and Utilization Agent mentioned before in section 3.

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