System-aided Self-improvement

\(^1\)Life-Optimization Project

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\(^1\)As of Feb. 2007, the title was changed to ‘Lifldea Project’
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Abstract

‘Life-Optimization Project’ (LOP) is an effort to reach the optimality in life. My realization was that most of us stay in sub-optimal status – much worse than what we deserve – and that state-of-the-art information technology can help us to handle this problem. Therefore, I devised novel theory and software that can help us deal with life more effectively, thereby enabling us to harness our full potential and attain higher level of satisfaction and achievement in life. More specifically, I wanted to find solutions to the following questions:

- How can we manage our knowledge and information better?
- How can we strike balance among many activities?
- How can we execute our plans effectively?
- How can we learn from past and avoid making repeated mistakes?
- How can we make lasting changes to our lives?

In detail, I introduce perspectives on life as a system to be optimized and suggest how we can improve our lives by more effective knowledge, goal, and action management. Then I introduce a set of software that addresses each part of these tasks: MyLEO – for goal and action management and MyKMS – for knowledge management. MyLEO is personal information management system with advanced features for statistical analysis and goal-setting. MyKMS is a Knowledge Management System based on the hybrid of Wiki and Blog, where each piece of knowledge is stored in the form of documents organized in tree-like hierarchy. The feature of each program will be introduced and the result of usage will be discussed.

While these solutions addressed the problem to some degree, several factors were found to severely limit their functionality, which prevent them from qualifying as the ultimate solution to LOP. In the last chapter, these limitations are discussed and a new architecture will be suggested as a candidate solution to LOP. In the end, as a future work, the vision of LOP and related fields of research is introduced.

Keywords: Personal Information Management, Knowledge Management, Self-improvement

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2 Acronym for ‘Make Your Life ExtraOrdinary’, also in homage to Leonardo Da Vinci - the one who showed limitless potential of humankind by example
1. Introduction

1.1. Overview

‘How can I improve my life? How can I take full potential out of myself?’ – these would be the questions we are asking to ourselves every day. Most of us want to improve our lives, feeling that we deserve something better than what we have. We might have dreams we strive for, or at least want to be happier. All in all, we would do anything if it makes our life something better.

While we want optimality so much, we are well aware of the reality that it’s very hard to make difference in life. Our goals seem so far. And the problems we’ve been suffering from seem so grave and intractable. After lifelong effort, most of us realize that it is better to settle down on where we are rather than making pointless effort to improve. That would be what Thoreau meant when he had said “Most men lead lives of quiet desperation and go to the grave with the song still in them.” [Thoreau1854]

As an ordinary man who has been thinking about this kind of problem, I have made years of effort to work on it. I started by writing some software with the purpose and improved it continually. Two Years later, however, I realized it took more than a well-written software to reach my goal. I decided that I needed to know what it means to reach the optimality of life. Therefore, I started to organize my idea on this issue.

First of all, I formulated what I have been dealing with. And I decided that I could name it Life-Optimization Project (LOP), since it was all about trying to reach ‘optimality’ in life. Once I defined what I was trying to do in this way, I could realize what to do more clearly. Since it is a kind of optimization, I needed to define ‘optimality’ first and find out how I can measure the degree of optimality. Then I could come up with a set of methodology that collectively helps up get closer to the optimality of given definition.

That’s how I wrote this paper. Here in this paper, I start by suggesting theoretical framework on life and its optimality, on top of which existing solutions to LOP will be analyzed. Then I introduce a set of software I created as a candidate solution for LOP.

This paper is the result of my effort spanning 4 years. While I myself am still at the very initial stages in working on this project, I consider this work the starting point of my lifelong effort. And I would be glad if this work would be of even the slightest help to anyone who is interested living beyond status quo.

1.2. Definition of Terms

1.2.1. Life

‘Life’ in this paper means everything within one’s range of cognition – what one does, feels and thinks of. What this definition of life excludes is one’s life observed by other people. In this sense, the focus of LOP is maximizing the value of one’s life as it is perceived by oneself.

1.2.2. Optimality

‘Optimality’ in general means most desirable status. In this thesis, optimality in life means the status considered most desirable in life. More detailed treatise on optimality will be present on section 1.5.1.
1.2.3. System (solution)

‘System’ is the product of LOP and refers to anything – theory, software and other artifacts – that helps oneself reach higher status in LOP. ‘Solution’ is synonymous with system.

1.2.4. Knowledge & Information (KNI)

‘Knowledge’ is the pattern extracted from information for some purposes. Knowledge gives better understanding about something (propositional knowledge) or some jobs (procedural knowledge). People gain knowledge from their everyday lives or learn from external source – other people, books, etc. ‘Information’ is the collection of data from one’s life. Information can be used in itself – figuring out the situation. More importantly, information can be used as a raw material from which knowledge can be extracted.

While we can make distinction between knowledge and information here, they are considered the target of knowledge management and will often be referred to together as ‘KNI’.

1.3. Background

1.3.1. Complexity of Life

Life has never been easy for mankind. As progress in science and technology has created a great deal of complexity in every dimension of human lives, it is becoming more and more difficult than ever. In addition to this complexity, what is worse, things are changing rapidly and the pace of this change is getting faster and faster. Some futurists like Ray Kurzweil [Kurzweil05] argue that men have achieved technological progress at exponential rate since the birth of civilization. Thanks to a great intellectual capability which each of us is born with, however, we somehow manage our lives. We learn from everything around, changing our behavior whenever appropriate and collaborating with other people for more complex problems. Unprecedented progress of information technology in the last 50 years still has not culminated to regenerate even the simplest revelation of human mental ability.

Yet ever-increasing complexity of life is posing a major challenge to our ability. We have to deal with complex and drastically changing environment, handling tons of KNI. Moreover, as a social being, we have to take a variety of roles and responsibilities, each of which require different set of knowledge, skill and attitude. A businessperson with rigorous quality standard at work may not want to treat his or her children in that manner at home.

While people are coping with this situation at their best anyway, many people feel overwhelmed, especially when they want to make any difference in their lives. They try to find simple principles which will help them get through with life, only to find that we need to know seemingly paradoxical virtues and apply them whenever appropriate, as Jim Collins called Stockdale Paradox. [Collins01] For instance, we need to focus on each of activities while maintaining overall balance in life. It is also required for us to be satisfied with what we are given while trying to improve them. Holding on to our own views while paying attention to the opinion of others is another imperative. All in all, it seems that we are asked too much for limited resources and capabilities we have.
1.3.2. Need for Life-optimization

Not many people may be satisfied with their lives. Even those who are content with their lives may have some parts which they want to make better. This basic need for enhancement makes people try lots of things. For instance, people read books expecting to find the right thing to do about their lives. They make plans to put what they learned into action.

To one’s disappointment, however, most of these efforts are unsuccessful. Some people fail to learn basic understanding on what they’re trying to do. Others may be unsuccessful in translating this knowledge into concrete goal and plan. Still others with sound goal and plan may not be able to practice what is resolved. Even for those who happened to practice what they know, it’s not easy to let the new practice take root in their lives.

On the basis of this problem do our characteristics as biological being lie. We easily forget what we have learned. Even things that we remembered don’t necessarily come up to our mental context when they are needed. And our process of thought cannot be free from a variety of cognitive biases, which prevents us from making right judgment. Most importantly, our action is affected by a number of environmental, psychological and other factors in addition to rational decision-making.

Indeed, there’s long way to go before one can change one’s life, which explains why most people compromise with their ideal. They are simply busy staying in the status quo.

1.3.3. What We Can Expect from Technology

While information technology has played a major role in this challenge to our mental capability, it is the same technology from which we can expect the rescue. Information technology enables us to store and process large amount of information effectively at little cost. Moreover, recent progress in the field of Artificial Intelligence and Data Mining provides us with the ability to extract patterns from large amount of raw data.

Given this power of technology, many of problems we’re facing can be solved. We can have the technology helping us to collect, organize and distribute the KNI. We can even make use of state-of-the-art technology in Computer Science to discover the knowledge previously not known.

The problem is that the available technology is not being used up to its full potential. While most of people use computer in their everyday activities, there is still a wide gap between what the technology promises and the benefit people are actually getting from it. Information is scattered across the device in incompatible manner. [Jones05] All in all, technology as of this moment seems to cause more problems than it solves.

Comparing this situation for individual to those of companies will make this point clearer. Most companies are currently using Management Information System (MIS) to improve productivity and have support in decision-making. Furthermore, since MIS is a collection of business rules in the form of information system, adopting MIS has additional benefit of having best business practices – a major marketing point of MIS vendors. While companies are enjoying this benefit of information technology to its full potential, why not people? Even admitting differences between business and life, there seem to be a big room for improvement in people’s lives with technology, which can provide much more than word processing and web surfing.

While it may take another 50 years to create human-level intelligence, it doesn’t look as daunting task to create a solution by which our intellectual capability is augmented, thereby helping us reach optimality of our lives. We’re provided with ever-growing power of technology. And we’re given with lots of candidate
solutions, starting from ‘memex’ [Bush45] suggested by Vannevar Bush and Man-Computer Symbiosis by J.C.R. Licklider [Licklider60] tens of years ago. On top of this technology and ideas, it seems obvious that we’ll have the solution that will suit our needs in the near future.

1.4. Traditional Approach

Judging from the significance of the issue, it is not surprising to find that many people have tried to find a solution that helps people manage knowledge, goal and action. And we already have tons of books, seminars, and so on advertised as quick life-changing solutions.

While these solutions suit our needs to some extent, each has distinctive drawback, as illustrated in Chart 1. Self-help books provide guidance on what is the right thing to do, yet they let the problem of practicing handled by the reader. In contrast, PIM softwares lack theoretical background – they weren’t made through enough of consideration – although they provide us with platforms for practicing their ideas. Franklin planner seems to have made much progress in that they combined sound theory with tools – i.e. planner – that help people to practice what they have learned. Yet it is inherently limited in that it is paper-based. Based on my experience, web-based version of Franklin Planner was like paper-based planner put directly on web, without rich usability-related features of web being utilized.

Chart 1 – Analysis of traditional solutions

1.4.1. Major Drawbacks

1.4.1.1. Lack of Completeness

The first problem with most of the solutions is that they touch only one part of the problem. Some of them deal with time management and others deal with relationship management. Depending on many heterogeneous solutions can cause confusion and inconsistency, thereby failing to get the effect desired. Moreover, these issues are intricately interwoven in life, which brings about the need for integrative and exhaustive solution.

1.4.1.2. Lack of Applicability

We come across many pieces of advice on how we can improve our lives. When we try to apply them to the problem at hand, however, we find that they don’t work as they are supposed to. The root of this problem may be that we had tried to use the solution of other people to our lives directly. Mark Foster
indicated this point for a number of time-management schemes each having different rules to follow. [Foster01] Since each person is inherently different in terms of who they are and what they're faced with, one needs solution taken from their own experience in order to have the best effect.

1.4.1.3. Lack of Theoretical Background

The problem with many PIM software designed primarily by software engineers are that they are built with little consideration for what kind of requirement people actually have on this kind of software. For instance, when I tried using Microsoft Outlook – arguably the most widely used personal information management system (PIMS) – I couldn’t resist its cluttered user interface (UI) of schedule management unit; I had to move several times from page to page in order to modify single information. I also found it inconvenient to have a pop-up window open for each schedule I insert or revise as I usually worked on many schedules at once. It would have been better if I could have modified all the information in a single page.

1.4.1.4. Lack of Support for Practice

Even if the solution is complete and applicable for individual situation, it may be of little use if it doesn’t provide any support that enables persistent practice of given solution. Since there exists a wide gap between having knowledge and taking it into action, one needs systematic support so that their knowledge can be effectively taken into action. This is the point many well-written self-help books lack, which give us awakening moments while reading, leaving us with no lasting change.

1.4.2. Some Pioneers

Before we move on the discussion of theoretical foundation, I will introduce some practitioners of LOP. These people exemplify how great one’s life can be through systematic and lifelong management.

1.4.2.1. Benjamin Franklin

As it is evident from his autobiography, Benjamin Franklin [Franklin96] exerted himself to reach the highest degree of perfection throughout his life. He devised a novel system – using paper and pencil – for his goal and effectively put his ideas into action. He listed fifteen virtues and tried to abide by one of them each week so that he can master all of them without distraction.

1.4.2.2. Lyuvishev

Lyuvishev – a Russian entomologist – was the man who have developed and practiced his own time management scheme throughout his life. [Granin74] Starting from at the age of 25 by recording the usage of his time and performing rigorous statistical analysis over the data, he continually improved every dimension of his life since then. As in the case of Benjamin Franklin, the quality and range of accomplishment he left as a scholar is beyond the imagination of ordinary people.

1.5. Framework of Analysis

From this section, we will discuss theoretical background of LOP. This will provide a sound and complete ground on which current and future work can stand.
1.5.1. Optimality of Life

I want to start by defining the optimality in life. While thorough treatise of this issue may lead to philosophical discussion, I think it is the status at which we reached our full potential throughout our lives. In more concrete terms, potential may mean whatever happens oneself during one’s life - achievement, property and even the feeling of satisfaction.

The Figure 1 below may illustrate this point clearly. On the highest level, there may be the highest status which a man can get. Yet our constraints may prevent us from reaching there, which leaves us only with the possibility to reach our own limit. The problem of most people, however, is that their lives remain far below their own limit.

![Figure 1 – Definition of optimality](image)

1.5.2. Perspectives on Life

Since our goal is to reach the highest degree of optimality, we’re still left with the problem of measuring it. Unless we can measure it, how would we know if we made any progress? This need for measurement leads us to the following two perspectives of life. As our target is life, a closer look on life can reveal a better specification of optimality.

![Figure 2 - Perspectives on life](image)

The Figure 2 illustrates two perspectives of life, each of which reveals its own definition of life. The left side of the figure shows the life as goal-achieving process where the achievement of smaller goals may eventually lead to the realization of vision. Since one can start by setting the vision then move on to smaller goals, we can consider it top-down approach of life, where the optimality can be defined as the degree to which one achieved one’s vision. For instance, a person with firm vision on his life, making plans based on his vision and trying to live up to those plans can be said to take a top-down perspective.
The right side denotes the life as the continuity of time, where the collection of schedule comprises a period, which in turn makes up a larger period. If we see life this way, the optimality of life will be achieved by staying in optimality each moment, which makes it a bottom-up approach in life. Typical practitioner of bottom-up approach may have a set of guiding principles, trying to abide by these each moment so that he or she can stay in the right status.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Top-down</th>
<th>Bottom-up</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>result-oriented</td>
<td>process-oriented</td>
</tr>
<tr>
<td></td>
<td>focus on global optimization</td>
<td>focus on local optimization</td>
</tr>
<tr>
<td></td>
<td>measurable, comparable using objective criteria</td>
<td>depend on subjective observation to measure the status</td>
</tr>
<tr>
<td>Strength</td>
<td>global perspective</td>
<td>concentration at the moment</td>
</tr>
<tr>
<td>Weakness</td>
<td>failure to concentrate on the problem at hand</td>
<td>local optimization may not lead to global optimization</td>
</tr>
</tbody>
</table>

Table 1 – Top-down vs. bottom-up perspective

As you can see from Table 1, each of these views has its ups and downs. Top-down sounds good in theory. We start from the global vision then follow the best path. Assuming that we have the right knowledge, it’ll be the solution that simply works.

Yet the problem is not that simple. As noted in background, the situations we are facing is inherently complex and we humans are far from logical beings, which explains why bottom-up approach often works better. Very often it happens that we cannot plan at all with given information. Even then, we should move on, not knowing whether it’ll work or not.

1.5.3. Steps Towards Optimality

In an effort to provide a solution in which every aspect of the problem is considered, I suggest a conceptual framework where the three steps toward optimality is specified, as illustrated in Figure 3 and Table 2. The framework shows how we can get to the optimality starting from the reality. As a starting point one may need to build sound and complete knowledge about oneself and one’s life, which is what knowledge management is about. The next step is goal management, in which the knowledge cumulated in the first step is translated into specific goals and plans so that they can be practiced and have impact. The final step would be action management, where one should practice what one knows and keep track of where one is. Note that goal management is based on top-down perspective on life, while bottom-up view is the foundation of action management. This framework is valuable in that it helps us to divide-and-conquer seemingly intractable problem of life.
Table 1: Knowledge Mgmt.

<table>
<thead>
<tr>
<th>Knowledge Mgmt.</th>
<th>search &amp; keep</th>
<th>We know where we are, what we have and which choices we’re given</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goal Mgmt.</td>
<td>prioritize &amp; plan</td>
<td>We decide on what to do, how to do</td>
</tr>
<tr>
<td>Action Mgmt.</td>
<td>practice &amp; monitor</td>
<td>We move on and keep track of how far we have come</td>
</tr>
</tbody>
</table>

While change in one’s mind and behavior can be a starting point toward optimality, it doesn’t complete the journey to life-optimization. Figure 4 illustrates how this change in mind and behavior can lead to our vision – optimality in life. Changes in mind in terms of what we know and believe will be reflected on our behavior. Once our behavior starts to change and this change persists, it’ll become our habit and we won’t need conscious effort to practice it. It is only after we have this long-term change in our behavior that our life does change. Conditions around us will start to change and people will perceive us differently from what they used to. In the long run, we’ll be in a kind of life which would be much closer to what we will have imagined.

Figure 4 – Model of change in one’s life

1.6. Steps to Optimality

Based on the framework suggested above, I will delve into each step to optimality in detail. This divide-and-conquer approach will help us to handle inherent complexity of life.

1.6.1. Knowledge Management

Let us use a common metaphor that life is a trip. As a traveler, before we decide on where to go and move toward our next destination, we may need to know where we are, what we have and what choices are available to us. If we apply these to our lives, we can have good ideas on what should be the target of knowledge management – who we are, what we’re working on and what options we have next. In other words, knowledge management is an effort to keep, extend and find what we know with minimal effort. While most people are aware of the significance of managing this knowledge, few people manage them systematically, as shown in Section 3.1.

Figure 5 denotes a model of flow in personal KNI. On the left side of picture is the information stage where raw information from internal and external sources accumulates in integrative information repository, from which we can search and browse information we have collected. External source of information includes every channel by which we learn new things, while internal source includes facts from our lives including schedule, to-do item, etc.

Since this collected information should be refined in order to create value, they are processed to become our knowledge, as seen on the right side of Figure 5. Once information is processed,
knowledge from internal and external sources are integrated to build knowledge repository, in which all that one knows about specific fields and life in general are put together.

**Source of Info, & Knowledge**
- Book
- People
- Media (TV / Newspaper)
- Internet

**Processed Source**
- Book Summary
- Quotes
- Web Clipping

**Information Repository**
- Collected Information of all types

**Knowledge Repository**
- Field Specific
- Field Specific
- Field Specific
- Know-How
- Know-Why
- Know-What

**Information from One’s Life**
- Schedule
- To-Do List
- Expenditure
- Contact Point

**Knowledge on One’s Life**
- Knowledge on Oneself
- Knowledge on People Around
- Knowledge on One’s Activities

**Figure 5 – Flow of personal information & knowledge**

1.6.2. **Goal Management**

After we has enough KNI, we can set the goal and build action plan by which what we know can be prioritized and kept in our mental context. We need to decide on what we will do and break each task into more manageable units (planning), assigning them to our schedule so that each can be practiced step-by-step (scheduling). The whole procedure is illustrated in Figure 6.

While this task seems simple at a glance, it is a complicated one involving a wide range of constraints. As for planning, among unit tasks there exist dependencies, illustrated as blue lines on timeline in the left side of Figure 6. Limitations for resources of various type – time, financial, physical, mental – imposes another constraint. Excessive plan for given resources will damage overall performance, while under-planning will lower the efficiency of resource utilization. Also, we should make sure that routines – repetitive tasks required to sustain one’s life – are not interrupted so that our lives can stay in homeostasis.

Effective scheduling requires a whole new set of considerations as well. Each schedule will create particular type of physical, mental and environmental context that is suitable only for some kind of jobs – e.g. it would be nice to write a love letter right after watching a romantic movie. Accordingly schedules should be arranged in a way that ensures the best execution possible. We should also be aware of real-world constraints such as delay, physical, mental fatigue, etc. As illustrated in the right side of Figure 6,
it is rather exceptional for each schedule to begin and end on time. And some schedules are highly volatile and therefore requires back-up plans.

Figure 6 – Cycle of plan, practice and evaluation

A number of restrictions and requirements illustrated above explain why we have many difficulties in goal management – planning and scheduling. It should be noted, however, that effective goal management is the only and the best way to alleviate the burden of next, possibly the most tricky phase in LOP – action management.

1.6.3. Action Management

Even after one has accumulated knowledge and have goals set, it's a long way before they are executed to make a difference in one's life. On this final step to optimality is action management, where plans are put into action to achieve goals. As action management surpasses the boundary of intellectual activity differently from knowledge and goal management, there is a whole new venue of considerations and difficulties in action management, which result in discouraging rate of success for most people.

Even though it should be a daunting task to illustrate what affects the actions we take, I tried that in Figure 7 in which the factors having influence over our action is categorized into context, situation, and mental process. The left side of the picture depicts what constitute our mental context – status, knowledge and task. In brief, status means physical and mental status of oneself. Knowledge means our prior knowledge and task means the job we have on our mental context. Consciously or not, each part of the context has profound impact on what action we take and how well we do it.

On top of our mental context, we perceive the situation and try to conclude what we should do next through the mental process of decision-making. While this process makes us seem like a logical being, as we all know, various factors undermine the quality of our decision. Moreover, driven by emotion or inertia, we usually don't even make a conscious decision before taking action.
From this analysis, I can derive the framework of action management – how we can optimize the execution of schedules. As depicted in Figure 8 the framework suggests that we need to optimize factors that affect, even generate, our action from bottom to top, one by one. First of all, we need to handle the situation – adjust environment and tools, do preparation job, collecting KNI as needed. Then we can optimize our mental context from which optimal mental process will emerge. We need to fetch collected KNI to our mental context so that we can act on the best of our KNI. Based on this KNI, we can organize – break down into pieces, prioritize and reorder – given task and motivate ourselves for the execution with maximum mental energy. Once we create appropriate mental context, we only have to get the job done, while avoiding cognitive bias and controlling emotion. Ideally, this whole process should be evaluated and put into knowledge base so that collected data can be processed and provide feedback for the future. For instance, we can identify which factors disturb our action, some of which are summarized in Table 3.
Figure 8 – Framework of action management

<table>
<thead>
<tr>
<th>Situation</th>
<th>Component</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>surroundings (other people) tools, preparation</td>
<td>unfavorable environment – noise, smell, lighting lack of equipment, preparation</td>
</tr>
<tr>
<td>Mental Context</td>
<td>status knowledge task</td>
<td>lack of motivation lack of knowledge fatigue / inertia excessive workload</td>
</tr>
<tr>
<td>Mental Process</td>
<td>perception thinking action</td>
<td>misjudgment cognitive bias</td>
</tr>
</tbody>
</table>

Table 3 – Types of difficulty in action management

While this framework provides step-by-step guidance of action management, there are more things to be considered. First of all, it is worthwhile to note that each step should be independent in a sense that each deserves attention in its own right. More specifically, when we are in a favorable situation and mental context, it is easy to become too relaxed and lose focus – we simply think that things can’t be wrong. Best condition, however, cannot ensure best result unless we stay focused during execution. Conversely, in no matter how bad a situation one may be faced with, as long as one does one’s best to make the best result possible, the outcome is usually much better than what one may have expected and one’s capability to handle difficulty grows as a bonus.

Another point is that we should keep best-effort attitude trying to avoid perfectionism. As mentioned in Section 1.3., we are mostly dealing with complicated and irrational situations with limited resources and capabilities everyday. In this circumstance, getting the best result requires having the best heuristic and knowing when, where and what to give up, not doing the most rigorous analysis and expecting the highest degree of perfection. This would be what Gerald M. Weinberg meant when he suggested ‘Don’t be rational; Be reasonable’ [Weinberg86] as a principle of real-world problem solving.

Action management is a handicapped game for everyone, full of difficulties. It is an effort to take full control over our own action as a biological being fraught with unwieldy desire and emotions. Even state-of-the-art tools and methodology cannot do more than alleviating just a part of these troubles. Yet it is
the last step toward the goal of life-optimization and the starting point of long-term change in oneself and one’s life, which gives reasons and guts for the challenge.

1.7. What LOP Will Do

As we finish reviewing theoretical foundation of LOP, it will be motivational to find out what trying to achieve the optimality will actually do for us. As briefly listed in Table 4, we'll find our life getting better in every aspect on our way to the optimality. When it comes to the life in general, we will be able to be freed from chronic problems and attain more desirable status by setting right goals and having continuous feedback. In terms of resource management, we will allocate resources at right places and utilize them most productively with better goal management. Moreover, we will stay in better physical, mental and environmental condition with better action management.

<table>
<thead>
<tr>
<th>Domain</th>
<th>Benefit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Life in general</td>
<td>Break bad habit / adopt desirable habit</td>
</tr>
<tr>
<td></td>
<td>Better resource (time/money/concern) management</td>
</tr>
<tr>
<td></td>
<td>Better overall condition</td>
</tr>
<tr>
<td>Relationship</td>
<td>Better memory in relation to other people</td>
</tr>
<tr>
<td></td>
<td>More time to spend with other people</td>
</tr>
<tr>
<td>Job</td>
<td>Improved performance in one’s profession</td>
</tr>
</tbody>
</table>

Table 4 - What LOP will actually do

For relationship, LOP will help us to remember better about other people by effective people-related knowledge management. Also, LOP will potentially have positive impact on performance at work by continually improving one’s knowledge and behavior. With a concrete example, we will find out what LOP can do in a specific situation.

1.7.1. Smoker Example

Let’s take an example of a person who is to quit smoking to illustrate what happens to most of us when we try to make a difference in life. As a starting point, he needs to understand what kind of detrimental impact smoking has on his health and which is the best way to quit smoking – there can be many quit-smoking tools, books and programs. Then he may set goals and action plans based on the KNI he collected. Finally, he will take action and keep it until he reached the goal.

While this sounds easy, it’s a long way to go in reality as evidenced by frustratingly low rate of success. He may have difficulty keeping the information he found in a way that he can easily refer to it later. And it won’t be easy for him to integrate his new goal and plan into his presumably overcrowded life. He may not be sure if he has enough resource to accomplish his goal and what else he should give up otherwise.

Once he managed to settle on his goal and plan, he may go through with continuous fight against his urge to smoke, only to realize it’s not easy to break old habit. Even after he succeeded for some periods, he can potentially go back to his old habit succumbing to inertia.

His chances for success would have been greater, however, if he had been equipped with right solutions. Knowledge management solution would have helped him to keep what he found intact. He could have reorganized his life after having new goal with goal management solution. He also could have survived incessant temptation of nicotine if he had got timely feedback on how the new lifestyle was improving his overall health condition. In this way, LOP can help people initiate and establish positive change.
2. Current Work

In an effort to provide systematic support for LOP, I made two programs. MyKMS is a Knowledge Management System that helps us organize what we know. And MyLEO is full-featured action management system that helps us manage a variety of personal information in an integrative manner so that we can minimize the gap between what we plan and what we do. For goal management, I used Microsoft Project because it helped me draw elegant Gantt chart. In Figure 9, the relationship among these solutions is depicted, where one’s life is divided into a set of hierarchical activities to which schedules are assigned. Evaluations given to each schedule will be accumulated in MyKMS and statistically analyzed to provide various forms of visualization in MyLEO. What are learned from schedule is applied to build a plan for the next period and will be reminded when we execute the plan in the future.

I will explain overall architecture of each system, which is followed by the introduction of major features. Then I provide brief explanation of PHP Class library which is technological foundation of MyLEO and MyKMS. This chapter will be concluded by providing data that shows how the software actually made positive impact on major goals of LOP.

![Figure 9 – Current work overview](image)

2.1. MyLEO

2.1.1. Overview

As an action management unit of life-optimization project, MyLEO – acronym of ‘Make Your Life ExtraOrdinary’ – provides a collection of features including schedule management, relationship
management and task management. While these features are common in most of existing PIMS, the strength of MyLEO is that each of these functions is tightly knit in a way that minimizes user burden for maintaining the system. Moreover, as seen on Screenshot 1, UI of MyLEO is designed for user to find and modify all the information one-stop without page-to-page movement.

2.1.2. Feature

2.1.2.1. Activity-based

Major feature of MyLEO is that every piece of information belongs to one or more of specific activity - a major building block of life. In other words, Activity is the fundamental unit which you divide your life into, and Activity-based structure enables you to deal with the inherent complexity of your life more effectively. In detail, you can plan, evaluate and view statistical information about your schedule by the activity. Activities have hierarchical structure in themselves. And schedule information can belong to more than one activity, since it is natural for some schedules to belong to more than one activity.

2.1.2.2. Rating & Tagging of Schedule

Another feature of MyLEO is that you can tag and rate your schedule. Tagging provides you with an option to express the characteristic of your schedule using one or more keywords, which can be used later when the user is trying to retrieve schedule of a certain type. And rating enables you to quantify the satisfaction of given schedule, which will be handed to statistics module to provide statistical analysis on life.
2.1.2.3. Statistical Analysis

What differentiates MyLEO from existing PIMS is the statistical analysis of given data. While existing solutions did nothing more than storing and querying information, the user of MyLEO can analyze input data in a variety of perspective. For instance, as seen on Screenshot 2, the user can see the total time and cost, average rating of the schedule by activities, from which one can see how much resource each activity takes and how each activity enhances or degrades overall satisfaction of one’s life. One can go further to view the trend of this information over specific periods. (Screenshot 3) The user can see what kind of change is happening to his or her life.
This statistical analysis on one's life makes crucial contribution to self management in that it provides oneself with factual information that shows what's happening in one's life in an objective manner. Each person makes a lot of effort to change one's life, yet these efforts are hard to persist without the idea on how much impact they have on one's life. With this feature, can have incentive to go on with positive changes and prevent any negative change before they become conspicuous.

2.1.2.4. Enhanced Functions for Action Management

In addition to basic schedule management, one can register and monitor some data which have significance to one's life. Those who are interested in losing weight can register their weight periodically and monitor how it changes, while those who is memorizing English vocabulary can measure how many words they have memorized. Since this data is visualized in the form of graph and put in the front page of MyLEO, the user can have incentive to manage those meters.

Another feature for action-management is principle-management which is inspired by the scheme Benjamin Franklin wrote about in his autobiography. As he conceived 15 virtues and marked on a sheet whether each virtue was kept or not, the user of MyLEO can put guiding principles in his life and mark whether he or she kept it or not.
2.2. MyKMS

2.2.1. Overview

MyKMS is a general-purpose knowledge management system (KMS) designed to support knowledge-related activity of an individual, as depicted in Figure 10. The user of MyKMS gathers information from a variety of sources and stores them in MyKMS, in which the knowledge is organized in organized manner that allows browsing and searching. Collected knowledge can be reviewed, distributed and deprecated as needed.

![MyKMS diagram]

**Figure 10 – MyKMS overview**
As seen on Screenshot 4, the front page of MyKMS looks like a hybrid of wiki and blog – page title on the top, formatted text as main contents and the list of recent postings on the right. It also has a tree of page hierarchy on the left side, from which pages can be browsed and be applied a set of page-wise actions via pop-up menu.

An example of administration UI is shown on the left side of Screenshot 5, where each role will be assigned read/write authority to a set of pages. On the right side of the same picture the UI for page editing is shown.
2.2.2. Architecture

Overall architecture of MyKMS can be shown using layer model as illustrated in Figure 11, with upper layers processing data from the layer just below. To illustrate this layered model from the bottom, raw contents are saved in storage layer using RDBMS – typically MySQL. Page contents and page metadata – e.g. page access privilege – are fetched from storage layer and assembled in raw contents layer in the form of plain text. This plain text will be parsed into the form of DOM (Document Object Model) to facilitate various type of processing. This DOM object can be saved in the form of XML document or be transformed into a variety of text formats – HTML, RTF, PDF and so on – via XSLT transformation. This layered structure might look a bit cumbersome at a glance. Yet each layer has vital functions that collectively satisfy intricate user requirements imposed on KMS.

For instance, contents version management would have been impossible if it were not for storage layer. Raw contents layer enables plain-text editing of contents, which is for easier contents creation. Also, processing layer enables a variety of contents manipulation such as the inclusion of the content of a page to another page. Lastly, transformation layer satisfies user requirement for contents portability by taking advantage of XSLT transformation.
Figure 11 – MyKMS architecture (layered view)

Figure 12 depicts the path through which user input data gets stored and processed to an appropriate form. Initially, user puts standard-format text in a variety of format. This text written by user is put into the content storage after being converted to standard-format text. Contents in storage can be parsed into the form of DOM object which can be used to create any format of document via XSLT stylesheet transformation. When HTML version of document is combined with HTML page template, we have a web UI.

Figure 12 - MyKMS architecture (data flow)
2.2.3. Feature

2.2.3.1. XML as Native Document Format

Most Wiki engines parse mark-up to resulting HTML page directly. And some of them have XML export options for contents portability. In MyKMS, mark-up text is initially parsed into XML DocBook-compliant DOM, which is transformed to resulting HTML document using XSLT transformation. This architecture is beneficial in that it ensures the separation of contents and presentation.

In MyKMS, native XML file contains the content and XSLT stylesheet have the information for presentation. In other words, the content and the presentation are separated. This enables one content to have multiple presentations. And presentation can be modified without affecting the content. Also, as native content is maintained in the form of DOM object, manipulation of page elements has never been easier. Various elements of a page can be queried using XPath command, which is how extraction of links was implemented. In addition, page elements can be modified using DOM object methods. Page index or contents inclusion macro was implemented in this way.

Having XML as a native document format will become a further advantage when we consider the future of the KMS. Recently there was a lively research on extending current KMS in a way that they contain more of semantic information. [Tazzoli04] And since most of semantic-enabling technologies are based on XML – RDF, OWL and so on, semantic extensions can be gracefully integrated to existing contents in MyKMS.

2.2.3.2. Hierarchical Organization of Pages

Traditional Wiki engines don’t support hierarchy among pages. But after 2 years of using Wiki as KMS prior to the development of MyKMS, I reached the conclusion that having hierarchy might have more benefits than drawbacks. The rationale is, first of all, hierarchy enables efficient browsing. In Wiki systems that doesn’t support hierarchy, we sometimes get lost since we have no information on where we are. Secondly, hierarchy enables the localization of management, thereby greatly reducing management job a modern KMS requires. For instance, page authorization setting for a page can be applied recursively to all descendent pages. And the statistics of contents usage, modification can be queried by the specific location on page tree.

**Figure 13** shows an example of page organization in MyKMS, showing whether each page is given read or write authority with color. As you can see, the user needs to set the authority only to the pages – page 1, 2, 4, and 6 – with different authority setting from their own parent pages.
2.2.3.3. Role-based User Authorization

Users with the same authority are given a specific role. Since page authority is given by the role, users in the same role are given the same authority and single change in role definition can modify the authority of all users belonging to the role. In Figure 14, the role A is assigned to user 1, 2 and 3, who are assigned the same authority to Page 1, 2 and 3.

2.2.3.4. Support for Blogging

Although MyKMS was initially designed to become the extension of Wiki specialized for KMS, since Blog started to be widely used for individual web publishing, MyKMS supports blog-compliant features – RSS, trackback – as another option for contents distribution.

2.3. PHP Class Library

On the basis of MyLEO and MyKMS there is PHP class library which provides common functionalities in
a standardized manner. Since most parts of MyLEO and MyKMS is implemented as a extension of this library, code duplication is minimized and new functions can be added with minimal revision. As depicted in Figure 15, PHP class library is grounded upon 4 base library classes which provides fundamental functions – HTML UI, file / database handling, logging – to other, higher-level classes. On top of this base library core library class provides major functionalities of application – user authentication, calendar, tabular data I/O. And these classes are extended to provide application-specific features.

2.3.1. DataWindow Class

In the core of this class library does DataWindow library provide standardized tabular data I/O interface. Given that data manipulation in tabular form takes up large part of every web application, the amount of savings in terms of code size and productivity made possible by DataWindow was considerable. Users can readily create tabular UI only by designating appropriate database table and column name. For instance, it took less than 10 lines of code to create the role configuration UI in MyKMS seen on Screenshot 5. And they can use advanced features such as sorting for multiple column and searching for multiple keywords as well as basic functions. DataWindow provides formatting using HTML template so that the users can customize Look & Feel of as they wish.

2.4. Result

In this section, I’ll review the result of applying 3 years of my life to the solutions above. I’ll mention how overall satisfaction of my life has changed, then how each activity contributed to this overall trend.

2.4.1. Analysis of Schedule by Tags

I tried analyzing tags put on schedule items from 2002 ~ 2006 with focus on desirable and undesirable patterns of behavior. Most of us have basic ideas on when we do well and when we don’t. We don’t, however, have precise and exhaustive data on what actually cause us to behave good or bad, which is what I got through tag analysis of schedule data in MyLEO. Table 5 below is brief summary of the analysis. Once I identify these causes, I can build plans to remedy each of them.

<table>
<thead>
<tr>
<th>Tag</th>
<th>Major Causes (* : frequency)</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reflection</td>
<td>More preparation needed ***</td>
<td>Major causes are excerpted from evaluation text of the schedules from 2002/11 ~ 2006/07</td>
</tr>
<tr>
<td>(I did something bad)</td>
<td>Overwork – condition worsened ***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Procrastination ***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>More plan needed **</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Unnecessary schedule **</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Inability in adjusting to changed situation **</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lack of temperance **</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lack of focus **</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lack of motivation **</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lack of courage, hesitation *</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lack of empathy to other people *</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bad physical condition *</td>
<td></td>
</tr>
<tr>
<td>Praise</td>
<td>Concentration ***</td>
<td></td>
</tr>
<tr>
<td>(I did something good)</td>
<td>Good preparation ***</td>
<td></td>
</tr>
</tbody>
</table>
2.4.2. **Statistical Findings**

2.4.2.1. Pushup Status Log

The first thing I measured after implementing status logging feature was the number of pushup. I set the status visible in the front page of MyLEO and added the data whenever I measured it. Surprisingly, the number almost tripled after two months since I started recording, which made me realize the value of motivation by data. Had it not been for the aid of this continuous feedback, I would not have achieved this progress.

![Chart 2 – Status log for pushup](image)

2.4.2.2. Overall Rating for Schedule

It became clear that the solution made a contribution to overall satisfaction of my life for last 3 years. **Chart 3**, which represents the monthly average of the rating over all schedules, shows higher value on the 3rd year with much smaller variance.

![Chart 3 – Overall rating](image)
2.4.2.3. Time Usage by Activity

Chart 4 shows the monthly trend of time usage by the activity. The time spent for activity ‘Job’ shows steady decline for the 3 years. And the time spent for research or learning is increased. One can find out what kind of changes had happened to one’s life in this way. For those who want to track what kind of change is happening to their lives, this data can be quite useful.

![Chart 4 – Time usage by activity](image)

2.4.2.4. Rating by Activity

Chart 5 represents how monthly average rating has changed for activity ‘Job’ and ‘Learning’ compared to the average over all activities. It can be inferred from this graph that activity ‘Job’ lowers and ‘Learning’ enhances overall satisfaction of life, since the rating for ‘Job’ is below the overall rating and the rating for ‘Learning’ is above. Although it may be impractical in this case to abandon one’s job, it’s possible to change – reduce activities with low satisfaction and increase the opposite case – the mixture of activities to enhance overall satisfaction.
2.4.3. Contribution of MyKMS

While MyLEO made crucial contribution for action management, MyKMS was proven to be an effective solution for knowledge management. I put most of knowledge from my life and external sources. Since the input content was stored in an organized manner, it was easy to retrieve the part of content I was looking for. For all the knowledge accumulated, I could turn it printable form or publish some part on web so that it can be accessible to other people. For those who needed some part of private knowledge, I created user accounts with authorities only to relevant pages.

More specifically, I publicized the summary of the books I read, research-related materials I had collected and essays I wrote on life and programming. In a variety of study group I participated, I created a set of pages related to the group and made it accessible to the members of the group. For people who wanted to hire me, I also created a role to which my career-related information – my skill, experience and qualification – was accessible. For my personal use, I put all the coursework-related material – the summary of each lecture, homework and project documents.

As time went by, MyKMS virtually became the electronic version of my brain. And the fact that all my knowledge was stored in a single repository made a big difference to the productivity of my knowledge activity. Since I knew that I can readily access to all the knowledge, I didn’t have to worry about where I put the information I was looking for. Also, I could make a connection among knowledge from different activities – coursework and research – and domain – computer science and mathematics – in the form of page-to-page link and very often this relationship was proven to be useful.
3. Future Work

While the project left some of clear outcomes, it became evident that it had some of problems that could be possibly solved only by complete re-design. In this chapter, I’ll focus on major drawbacks of current approach and how these should be addressed in the future solution. Then, a new architecture and the long-term vision will be introduced as a future work.

3.1. Survey

As an effort to find out what people think about this issue, I performed a survey on the practice of major parts of LOP – time management and knowledge management over 50 students in Seoul National University. According to the result of survey, it was found that many people feel the need to manage their lives in a more organized manner, and current solutions are not fulfilling the needs of people in general. Franklin Planner and other paper-based planner were prevalent as means of time management. And almost half of people were not practicing knowledge management at all, while sympathizing with the need for knowledge management in keeping a journal or storing job-related information. For major reasons of discontentment from the solutions, the burden of data input and the difficulty of finding the data took more than 60%.

![Chart 6 – Survey result (2006/07, for 50 students in Seoul National University)](chart)

3.2. Direction

Based on my experience and the result of survey, I’ll suggest future direction of LOP – what next-generation personal information management system should provide.
3.2.1. Ubiquitous Automation

3.2.1.1. Automatic Collection of Input Data

In the heart of personal information management, there is the issue of collecting information relevant to one’s life, since no system could produce meaningful output without having input data right. And it should be considered that user intervention be minimized in the process of collection, given that the user-input data is usually error-prone and user interaction with this kind of system should be a lot greater than any other. The survey result above also indicates that users have difficulty with the job of collecting data.

Several research projects have suggested the possibility of collecting data from one’s life. MyLifeBits project [Gemmel06] was an effort to collect a wide range of data – e-mail, call record, even health records – from one’s life as they emerge without user intervention. And companies such as BodyMedia are developing technologies for collecting one’s metabolic information using small wearable device.

3.2.1.2. Automatic Organization of Input Data

Data collected from one’s life can have value only when they are organized in a way that supports future user requests. The data should be put in a proper location inside the storage having linkage with whatever items it has any relation with. The problem is that the cost of this organization task is unbearably high and increases in proportion to the amount and complexity of input data. For instance, as the contents in MyKMS increased, it became burdensome to decide where in page hierarchy the new content should be put. Therefore, it would be desirable for the system to handle this organization job. A key enhancement in the new architecture suggested in Section 3.3. is the organization of user input data using statistical analysis and natural language processing.

3.2.2. Intelligent Features

On top of the abundance in high-quality data collected from one’s life made possible by ubiquitous automation, many intelligent features will be possible, which will turn an information system to a reliable partner and advisor of one’s life.

3.2.2.1. Smart Scheduling & Monitoring

Given the data on physical and mental conditions, one’s schedule patterns and plans for the future, the system can suggest the best schedule possible in which most of constraints are considered. Since the system can learn from how the user practiced given schedule, it can successively provide better schedule scheme. And the system can monitor the user on whether any undesirable behavioral pattern is happened, in which case the system will warn user of the situation it detected. Of course, the user may ignore the sign, yet one can get a real-time feedback on one’s situation in this way.

3.2.2.2. Extension of Knowledge via Machine-to-machine Communication

Once KNI of one’s interest is stored in organized manner, it can be extended by communicating with external source or another knowledge base. While most source of information on the internet is designed only for human, the vision of semantic web will make web more accessible for machine agents as well. This idea will be further specified in Section 3.4 – grand vision of LOP.
3.2.3. Security and Availability

One thing I learned after years of experience in using self-made PIM software was that PIM softwares are required to have the highest quality standard in terms of security and availability. Since PIM software contains most of critical personal information, it can cause disaster if the data is exposed or damaged. Moreover, the life of user will have major impact if the software doesn’t work just for a few hours.

3.3. New Architecture

As a next step toward the vision of LOP, I’ll provide a simple sketch of new design in comparison to the architecture of current solution – MyLEO and MyKMS. Figure 16 illustrates the architecture of current solution. You can find that information items are put in a separate storage by its type – schedule, to-do and contact. And the knowledge is stored in the form of document which is organized in a tree, imposing on considerable burden for the user. Relationship between information items or between information item and knowledge can be expressed, yet only manually by user.

![Figure 16 – Current architecture](image)

The new architecture is depicted in Figure 17. Every information item is put in a homogeneous storage with type-specific information attached on top of generic data structure. For every information item, the system extracts keyword and the various kinds of relationship among them from input data, thereby building the graph of keywords and relationships among them. For derivation of relationship among concepts, querying external database like Google and WordNet as well as statistical method based on co-occurrence analysis can be used. Based on this semantic network of concepts, the user can browse information across the boundary of types. Also, considerable portion of structured information – schedule, contact, to-do – can be extracted from user input without filling the forms of traditional UI. This whole organization task is handled by the system behind-the-scenes, with no user intervention.

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3 Semantic distance between terms can be found by the number of query results using target terms together.
4 Concepts located in close proximity to each other in WordNet database are considered to have relationship.
5 Concepts appearing in the same sentence, paragraph, documents are considered to have close relationship.
Once I conceived this new design, the next thing to do was getting the technology that could make this new design work. After strenuous search, I found the technology I was looking for existed in the domain of bioinformatics - literature-based knowledge discovery [Lans04], whose major interest is to find out novel relationships of scientific concepts from a large collection of scientific literature. I also found several interesting papers from the field of Text Mining [Zhang05] and, more specifically, Information Extraction. [McCallum06] Since the key challenge of the new design was to discover clues of organization from input documents, it became evident that I could take advantage of these technologies for the implementation of the new design.

As for the implementation platform, since PHP is verbose in its syntax and didn’t scale well for large project, I decided to use Ruby language and Rails framework. Ruby’s succinct yet expressive grammar, Rails’ space-efficiency and AJAX support were major reasons for the change. Also, for managing the concepts and relationship among concepts in a portable manner, Topic Map [Pepper03] can be used.

3.4. Grand Vision – Brain Augmenter

While the new architecture suggested above can be a step forward to the vision of LOP, it should be worthwhile to envision what the ultimate solution to LOP should be – whether it is feasible with current technology or not. Figure 18 depicts this grand vision of LOP, which I named Brain Augmenter to emphasize its role as an augmentation of human intelligence.

As you can see from the Figure 18, the Brain Augmenter is more than a passive storage of personal KNI. It will continuously collect information from the user through a variety of sensors that transmit information on user’s life, interact with other systems to find out what had happened to other people and communicate with external source to extend the KNI of the topic which the user is interested in. Through this ubiquitous collection procedure, the Brain Augmenter will maintain a great quantity and variety of high-quality data on one’s life, effectively augmenting limited ability of our brain to store and keep things. Enhanced means of human-to-machine and machine-to-machine communication is critical for Brain Augmenter to work, as specified in Table 6.
For the system to qualify as an ultimate solution to LOP, it should go one step further to discover new knowledge from the data it collected. Since we have all types of personal KNI kept in the system in a highly-organized manner, we can let the system find many novel and meaningful patterns from the data, which can readily affect our action to change our behavioral pattern. For instance, if the system has the information of both one’s schedule and one’s emotional status, it can combine the data to infer which schedule is most effective to keep desirable emotional status.

3.4.1. How It Will Change One’s Life

Once this vision of Brain Augmenter is realized, it is expected to bring groundbreaking changes to the lives of people. In terms of knowledge management, first of all, every user of the system will be equipped with literally photographic memory – digital photography is actually a big part of the data. Since all the information from their lives will be recorded, people are going to be able to instantly recall most part of their past. Also, reliable data on resource usage will be collected in unobtrusive ways. Secondly, it addition to the data from one’s life, people will find their knowledge and information grow unconsciously by the system – mostly via machine-to-machine communication. Once people put a piece of information on a topic, the system will find and append what are relevant.

As for goal and action management, based on the data it collected, the system can provide wide range of guidance that will make a difference in one’s life. For instance, based on resource usage statistics and task progress status, it can tell the user how resource should be re-allocated for more effective execution of one’s goal. As a more specific example, based on speech data it collected, it can let us know what we can do to improve our oral communication skill.

Since the system will provide continuous and real-time feedback on how one’s changed behavior is taking effect on the other parts of one’s life, we will have much higher incentive to keep the positive change. All these functionalities will collectively help us find out, aim at and practice what is the best of each of us in life – true life-optimization achieved.
It may naïve, however, to expect that this revolution will have only bright sides. Large collection of high-quality data can be exposed and taken advantage of by other people and organizations, potentially causing a big threat to the privacy of individuals. Moreover, as their life get more and more dependent on the direction and control of systems, people may find themselves having great difficulty for just a short downtime or small malfunction.

<table>
<thead>
<tr>
<th>Interface Type / Format</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>human-to-machine</td>
<td></td>
</tr>
<tr>
<td>communication</td>
<td>typical input device</td>
</tr>
<tr>
<td></td>
<td>speech</td>
</tr>
<tr>
<td></td>
<td>sensor (GPS, metabolism)</td>
</tr>
<tr>
<td></td>
<td>communication record</td>
</tr>
<tr>
<td></td>
<td>(e-mail, telephone)</td>
</tr>
<tr>
<td></td>
<td>metabolic information</td>
</tr>
<tr>
<td></td>
<td>(physical / mental status)</td>
</tr>
<tr>
<td></td>
<td>symbolic information</td>
</tr>
<tr>
<td></td>
<td>(daily journal / memo)</td>
</tr>
<tr>
<td>machine-to-machine</td>
<td></td>
</tr>
<tr>
<td>communication</td>
<td>the format of standard data exchange</td>
</tr>
<tr>
<td></td>
<td>schedule negotiation</td>
</tr>
<tr>
<td></td>
<td>knowledge augmentation</td>
</tr>
</tbody>
</table>

Table 6 – Types of communication

3.4.2. Adoption Scenario and Long-term Prospect

Initially, Brain Augmenter will be adopted to professionals who are highly aware of their performance. Yet it will spread to people with any age and walk of life, since it is about not only being successful at work but more fulfilling life in general. Sooner or later parents may want their children to have support from the system in developing their talent and building desirable personality. The system will also enable each parent to monitor the lives of their children and provide appropriate advice whenever needed.

![Figure 19](image)

Figure 19 – Long-term Prospect of Brain Augmenter

Figure 19 depicts the architectural prospect of Brain Augmenter after years of mainstream adoption. On top of generic architecture which provides functionalities common to all the people, there will be extension modules specialized for some job or role – requirements from a scientist and an athlete will be quite different. These modules will be used throughout their lifetime and help people to be more effective on corresponding parts of life. It is not feasible, however, that all the vagaries of life can be handled by a couple of modules. There should be systems for ad hoc situations people come across. For instance, when people attend a conference, there can be an extension module which helps them to communicate with other participants and provide feedback. The number of these situation-specific and momentary modules can be infinite.

3.5. Related Fields of Research

I’ll look through related fields of research and reveal how each field can make us get closer to our vision.
Figure 20 – Related fields of research

Figure 20 is the depiction on the related fields of research, which shows three fields of science related to our concern. Computer science provides technology to create the system as means of problem-solving, while cognitive science helps us understand human cognition as the user of the system. And information science deals with the information and data as the content of the system. More specific fields of research and major goals of each field are listed in Table 7.

<table>
<thead>
<tr>
<th>Field of Research / Text Mining</th>
<th>Major Goal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural Language Processing</td>
<td>extraction of semantic information from text</td>
</tr>
<tr>
<td></td>
<td>real-time dialogue</td>
</tr>
<tr>
<td>Human-computer Interaction</td>
<td>multi-modal interface</td>
</tr>
<tr>
<td></td>
<td>(speech as a primary medium)</td>
</tr>
<tr>
<td>Knowledge Representation</td>
<td>semantic-rich representation of knowledge</td>
</tr>
<tr>
<td></td>
<td>standardized machine-to-machine communication</td>
</tr>
<tr>
<td>Database / Information Retrieval</td>
<td>high-performance storage for mass / varied-type data</td>
</tr>
<tr>
<td>Artificial Intelligence</td>
<td>pattern extraction over mass / varied-type data</td>
</tr>
<tr>
<td></td>
<td>cognitive architecture</td>
</tr>
<tr>
<td>Cognitive Psychology / Neuroscience / Physiology</td>
<td>cognitive bias</td>
</tr>
<tr>
<td></td>
<td>monitoring of physical / mental activity</td>
</tr>
</tbody>
</table>

Table 7 – Major goals for relevant fields of research

For natural and effortless human-to-machine interface, speech should be a primary medium of communication and Natural Language Processing technology capable of taking command and providing information via real-time dialogue will be essential. In addition to speech, any meaningful combination of input devices will be used to form a multi-modal interface that collectively provides optimal user interface; while speaking to the system, the user will pinpoint a specific part of a screen to clarify his intention. Cognitive architecture which itself is a computational model of human cognition will play a role in validating this hybrid human-to-machine, as noted from the application to cell-phone design. [Ritter04]

Another major prerequisite for Brain Augmenter is semantic-rich associative storage of personal knowledge and information with capacity enough to contain all the digitized data throughout one’s lifetime. Moreover, as is the case of human brain, the system must be capable of self-organization and instant retrieval for any part of data requested by user. Also, for the system to be able to extract valuable pattern from input data, it should be equipped with advanced machine learning algorithm.
Technology related to standardized machine-to-machine interface, which can potentially ease the information-processing workload of people considerably, would be another obstacle to overcome. Yet there seem to be lively research activities around this area including standardization efforts for semantic web and ontology.

For human-side of the research, we will need means to collect a variety of data from one’s life – physical and mental status, communication records and so on – with little user intervention which will comprise another part of human-to-machine interface. For effective goal management, further research on human behavioral characteristic in performing everyday activities will be needed. Moreover, to minimize plan-action gap – a major challenge of action management, we need to know what causes sub-optimal behavior – emotion, cognitive bias and so on – and how to remedy them.

Even technological progress mentioned above are all achieved, there are some domain-specific challenges to be overcome. For instance, although the time usage statistics is basic to many applications, even with all the data captured from one’s life, it is not easy to figure out what the person is actually doing – perhaps before we are able to scan and log what one is thinking constantly. There should be some heuristics that can help us measure the data at least as precisely as we need.
4. Conclusion

Throughout this paper, we have inquired into what it takes to reach the optimality in life and how information technology can help us with the vision of optimal life. While it may take considerable progress across many disciplines to reach our goal, it will produce a lot of things that can potentially bring about the progress of all relevant fields, just as the vision of human-level intelligence did for the field of Artificial Intelligence.

Another point worth remarking is that we should not be excessively dependent on system. Whereas one of basic assumption of this paper is that the system will help us by extending our intellectual capability, it should be noted that this augmentation can have adverse influence on our own ability to learn, remember and practice, thereby resulting in little or even negative net gain for the final outcome. If the system is smart enough, however, it has to notify the user whenever the user gets too dependent on the system.

It all started from a simple calendar application more than 4 years ago. At that time, I just learned PHP language and wanted to create something useful. For a year or two, it was nothing more than a pastime activity of mine. Never did I imagine that it would grow to be a lifelong project that became the mission of my life. As I am finishing this paper, however, I have a very strong feeling that I am in the beginning of something very important – a revolution that can help people to live to their full potential. I cannot be sure on when it will reach its goal, yet I know that I found something worth living for.

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