Abstract
Goals and goal-setting play an important role in personal informatics because they link the data within personal informatics systems to core problems in people’s lives. This paper presents a framework for personal informatics based on a user model representing user goals. We are creating a domain specific ontology for setting lifelong wellbeing goals, and a generic ontology of attributes associated with goals based on goal-setting theory. We envisage that this novel approach will facilitate personal lifelong goal management for individual users.

Keywords
Goal, Goal-setting theory, Personal informatics, Applications supporting Well-being

ACM Classification Keywords
H.5.m [Information interfaces and presentation (e.g., HCI)]: Miscellaneous.

General Terms
Documentation, Standardization

Introduction
Goals are considered an important means of self-regulation and monitoring [7]. They are also critical for the behaviour changes needed for many improvements
in people’s lives [2]. Effective goal-setting can motivate people to maintain their healthy lifestyle and wellbeing and facilitate behaviour changes [4].

Commercial personal informatics tools for goal-setting (e.g. Lifetick 1, GoalsOnTrack 2, Health Month3, StickK4) and persuasive systems [3, 5, 8] support different theory driven goal management strategies for behaviour change. Some have support for linking personal digital devices to relevant goals. Yet users still face challenges in identifying realistic lifelong goals that are likely to help them achieve their desired behaviour changes.

To address these issues, we are developing a framework for personal informatics systems based on a user model that holds models for goals derived from a domain specific ontology for wellbeing and a generic ontology of attributes associated with goals, based on goal-setting theory. We call this ontology “Generic ontology” in rest of this paper.

A user model is the repository of personal information that has the potential to drive personalisation and learning. Coupled with a user interface, it can also support self-reflection and monitoring. In turn, this can improve lifelong goal management in several ways. It may help the user to link personal digital devices (e.g. activity sensors) to relevant goals. It may provide personalised assistance so that the user can focus on the most important goal, revise current goals in a given context, and set new goals.

Our proposed framework aims to support these functionalities. It builds upon the Personis lifelong user modelling framework [1] which was designed to support effective user control over self-monitoring and privacy.

In next section summarise some key ideas from goal-setting theories relating to our generic ontology. Then we review the related work and discuss our proposed theoretical model.

Goal and Goal-Setting Theory
Goals are important as they help people motivate themselves in reaching a better position in different sectors in their lives [9]. Goals can be assigned, participatory or self-set. We only consider here the self-set goals.

Since our generic ontology is based on the goal-setting theory, we briefly point out the attributes and moderators we need to consider. Goal-setting theory [9] established that proximal, specific, difficult yet attainable goals result in higher task performance compared to “no goals” or “easy goals”. So the attributes of proximity, specificity, difficulty and attainability are included in the ontology.

The generic ontology also includes moderators such as commitment to goal attainment and positive feedback, as these can further increase motivation and performance. Commitment, in turn, is influenced by importance and self-efficacy.

Our system will use this ontology for creating a dynamic questionnaire based on standard guidelines (e.g. self-efficacy guidelines) for the user while setting a goal.

Related Work
In recent years, a number of health and wellbeing applications have been developed that encourage people to adopt a healthy lifestyle [3, 5, 8]. While these systems are quite sophisticated and enhance awareness and

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1 www.lifetick.com
2 www.goalsontrack.com
3 www.healthmonth.com
4 www.stickK.com
motivation, they do not allow users to set and monitor personal lifelong goals. Moreover, none of these systems allow users to control their personal information and link it to related goals.

The “Ubifit” system [3] supports theory driven self-set goals with feedback through a glanceable mobile display. Our aims have much in common with this work, as our proposed framework enable users to set their goals and task strategies. Ubifit, however, does not consider previous records or perform self-efficacy tests to support the user setting a goal. Some work has explored various aspects of user control in personal health informatics frameworks [10, 6], but these also did not allow users to monitor their personal goals over long term.

Theoretical Model
We have extended the underlying Personis framework to support the representation of goals, including hierarchies of subgoals and mechanisms to link evidence to goals. The goal hierarchy follows from a domain specific ontology, while the goal attributes come from the generic ontology. For example, if a user sets a goal for increasing activity level by walking 10,000 steps a day, the goal will be stored following a hierarchy for the “Activities” category and the “Walking” subcategory. This goal conforms with the specificity attribute.

Figure 1 shows the core elements of our user modelling framework for goals. At the top is a user interface which enables the user to define goals and link them to the flow of information from sensors. This interface also helps the user to set a notification for a particular goal. Moreover, this provides support for logging and editing personal data and monitoring long term goals.

![Figure 1: Framework for Modelling Goals.](image-url)

In the middle left, we can see the new elements added to the Personis framework: an ontology database with a generic ontology for goal attributes and domain specific ontology for goals, goal models set by the user and models of the external systems or devices. For example, referring to the 10,000 steps walking goal, a user with a Fitbit sensor might decide to link the Fitbit sensor (at the bottom) data to this goal. He might install a Fitbit plugin “FitbitConnect App” (left most oval at the bottom) and build a model for Fitbit inside “apps model” which will hold the step-counts from his fitbit sensor.

In the middle right in Figure 1 are the notification systems the user can choose. This may be a passive display, such as emerging low cost displays which are unobtrusive and subtle indicators of simple status, a form of glanceable display [3] to help a person maintain awareness of

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5 www.fitbit.com
information about an important current health goal. Or it may be an active display or a form of alert which captures the user’s attention.

**Conclusion**

The contribution of this paper is to introduce an approach to support people in achieving their lifelong health and wellness goal. It is based on a user modelling infrastructure that supports goal setting based on a generic ontology of goal attributes and a domain specific ontology, both in terms of the technical underlying framework and user interfaces for controlling the storage and use of personal data from the personal digital devices and applications. To achieve user controlled goal-setting, this framework will provide interfaces for managing goals and reflection: defining goals; monitoring the information associated with each goal; reviewing goals. It must also provide interfaces for linking each sensor into the infrastructure and linking it to the relevant goals. And critically, to help the user tackle these tasks, it provides a user modelling system to assist in the challenging tasks of thinking about goal setting, revision and self-reflection and monitoring over the long term data about health and wellness.

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**References**


