The tao[1] of metabadge

metabadge – simplicity in a personal memory device

metabadge is a wearable, personal memory amplifier. It uses sound, voice and light to remind of things you need to know, and records things you want to remember. metabadge is small enough to carry with you all the time, in your shirt pocket, or clipped under your shirt collar.

metabadge synchronizes automatically to your pc wirelessly, so there is no need for cradles – even if you pop into your office for a few minutes between meetings, metabadge updates itself.

metabadge extends desktop calendar applications such as Microsoft Outlook, Palm Calendar, or Apple iCal, past the limitations of your desktop or even your laptop, making it possible to hear your reminders and record to-do items anytime, anyplace.

metabadge extends the messages, files, and people connection network built by Creo's Six Degrees product, and adds location to the context of retrieving the most relevant nuggets of information from the sea of digital data you deal with every day.

metabadge – our customers

The primary metabadge market is similar to the early Palm Pilot user base. Technically savvy enough to install software on their machines, metabadge users buy it themselves, but use it for business and personal purposes, attempting to buy technologies that save time rather than waste it – to help them be more organized without additional effort of planning.

Our users buy their metabadge because it is small enough to wear, easy to use without fussing, and is independent of a cell phone. Since metabadge is handsfree, people can use it while they are busy with their hands, and do not have to be able to read small text in lcd displays to operate it or retrieve the information they are looking for.

Our customers manage multiple schedules, and wear several hats. At the office, they are asked to meet many demands on their time. Their personal schedule sometimes overlaps, such as when school closes early some days, or for a Christmas concert. They need to coordinate schedules among other people, at work using their corporate server-based system, as well as with their spouse and friends. Their travel schedule sometimes affects both.

[1] Tao represents the Chinese character 道, which means "the way". Respectfully inspired from the Palm document "The Zen of Palm"

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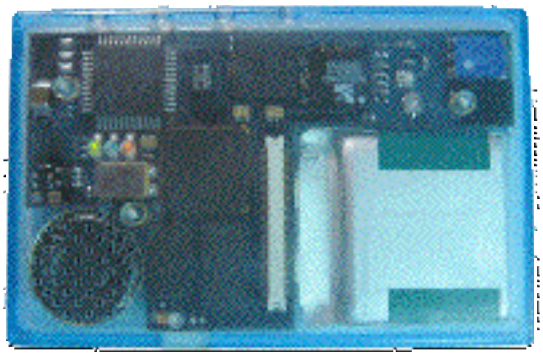
Target price is in the gadget range for personal productivity, which hover around $249.

metabadge – technology

metabadge represents a completely new hardware technology to Creo. While the focus of our prepress business has been on speed, and electronics represent a small proportion of our product cost, metabadge's primary cost is the electronics. As a consumer device, one competitive differentiator to PDAs is that without a screen or keyboard, metabadge can be small enough to be constantly worn by the owner, ensuring it is there when needed. Being a small and light device is a key success factor, so the design and prototype manufacturing has made use of a high density circuit board, with 8 layers and internal routings, as well as the most recent innovations in bga (ball-grid array) surface mount technology and 1.8 volt electronics. Power is supplied from a rechargeable lithium-ion battery, which is rapidly replacing Nicd and NiMh storage because of its high energy density, memoryless discharge, and flexible shape and size. The case pictured here is 2.8" (72 mm) by 1.8" (46 mm) and is 0.3" (7.5 mm) thick, making it about 1/15 the size of a Pocket-PC cellphone.



Metabadge includes a Bluetooth™ digital radio, using it for the third-wave of anticipated radio use, exploiting **proximity technology** of the **personal area network**. While Bluetooth technology has been used mainly for cable replacement, the specification provides a discovery protocol, for Bluetooth devices to query and find other devices, and reliable message passing. Growth in Bluetooth chip sets is exponentially growing for cellular telephones, and in-car communication systems, where potential synergies with hands-free units and gps location systems make location-related context filters for reminders possible.

Metabadge competition

The primary competition to metabadge are pda-merged cell phones, in particular the Microsoft smartphone 2002 that is just beginning to come into the market (Sept 2002, Sendo Z100). Smart-phones include integration with Exchange servers for contact, email and calendar functions. As Bluetooth becomes more widely available on Pcs and telephones, it may be possible to write metabadge-like applications on cell phones.

Creo's strategy is to be first to market with a less expensive, easier to use, dedicated wireless device that is small enough to be unobtrusive, while being attractive and functional enough to be worn rather than carried. Package design and user interaction are differentiators for metabadge.

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Unlike PDAs and Cell-phones, metabadge avoide the compromise of desiring to be small enough to wear with the conflicting goal of a readable display, and data entry using a stylus. Metabadge's dependence on voice as the interface medium is a unique strength. Many PDA users have become disillusioned with the difficulty of reading from a small screen, and the complexity of writing notes using a stylus or pressing tiny keys.

Most PDA users make use of the lookup and reminder capabilities.

Voice reminders are not necessarily better than visual text reminders. They are different, and can be peformed with a much smaller device than one with a screen. This distinction will differentiate metabadge cuistomers and identify our target market.

metabadge – interactions

The metabadge user interaction is primarily through touch, sound, and sight. metabadge has a **non-textual** interface – there is no screen, there is no keyboard or stylus.

Rather than a limitation, metabadge relies on its interface simplicity to convey a small set of functions, suitable for use when the metabadge is used in a personal space. When coupled with a PC, the full set of metabadge features becomes available.

So, it is critical that the interaction that metabadge supports is appropriate to its capabilities. Many consumers have faced **interaction dissonance**, where a device with few controls are overloaded and become incomprehensible to its owner. Examples include:

1. Invisible modes
2. Inconsistent use of controls
3. Insufficient feedback

For metabadge, the ease of interaction is a key differentiator compared to keyboard and stylus devices. Designers of metabadge applications must keep in mind the barest of functions and exercise *wabi-sabi*[2] discipline.

metabadge sounds

metabadge's onboard speaker is used to signal events to its owner. The primary events are reminders, proximity, and warnings. The speaker can also play other sounds such as synthesized voice, the key metabadge replacement for output.

Like the Victorian model of a well-behaved child, metabadge does not speak out of turn. An alert sound signals to the user that a spoken announcement is awaiting a chance to speak.

[2] Wabisabi represents a Japanese world view or aesthetic system that values simplicity, humility, and change.

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Since metabadge is a Bluetooth™ device, it can support the headset profile, a way of directing audio input and output to a headset rather than the built-in speak and microphone. When a headset is paired to the metabadge, applications do not need to pause for permission before speaking, they can continue immediately after sounding their alert tone.

It is possible for the metabadge os or other applications to attempt to play sounds at the same time. When this occurs, the sound manager mixes the audio sources to play simultaneously rather than queue them for serial play.

metabadge buttons

metabadge supports one toggle, and one thumbwheel. Both enable **pressing**, while the toggle enables **stepping**, and the thumbwheel enables **scrolling**. Scrolling and stepping use either a "forward/backward," usually for time, or and "up/down," or "next/previous" metaphor, usually for proceeding through a list.

Toggling selects the "next" or "previous" application resident on the metabadge that has user-selectable features. Examples are "reminder," "memo," and "sound"

The toggle's ability to act as a button is used as a play/record/pause button, to signal the metabadge when it is allowed to speak, should cease speaking.

Holding the toggle button down for more than one second acts as a shortcut to the memo application, i.e. it acts as if the user had used the toggle to shift to the memo application, and begins to record a new memo.

The scrollwheel acts in an analogous manner to the tuning knob of an old radio. Turning the scrollwheel slowly advances one step at a time, but it can be spun, which advances more quickly through the list.

Each time the scroll wheel is advanced, a sound is played which provides feedback to the wearer as to the speed of their scroll. Scroll speed may be nonlinear, providing much faster scrolling when the velocity of the scroll wheel is high. Nonlinear scrolling allows a wearer to listen to appointments a few hours or a few months away by receiving feedback as to where scroll speed sets the time.

The actual sound played by the scroll wheel depends on the application. By default, the "scroll up/scroll down" metabadge os sounds are played, which are short clicks. Applications can override this sound, for example reminder overrides the scroll sound by playing the time of the next/previous appointment. Pressing the scroll wheel plays the complete reminder corresponding to the time that was set by scrolling.

The "sound" application overrides the scroll sound by actually playing each sound in the metabadge's sound library, using the scroll wheel to move back and forth through the sounds. Sound play is interruptible – scrolling to another sound while one is playing immediately replaces the playing sounds with the new sound.

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The scrollwheel button is reserved for toggling its meaning to a volume control. When in volume control mode, scrolling plays the "click" system sound at appropriately higher or lower volumes.

metabadge visuals

metabadge supports four light-emitting diodes, three of which are under software control, the other is used by the power maintenance system.

The LEDs under application control always come on and go off in a smooth, ramping up manner, softly transitioning from off to on, rather than the typical digital mode of being 100% on or off. Soft transitions are part of metabadge message of being a human, easy-to-live with technology.

Specifying LED uses three terms, transition time (□), duration (□), and period (T).

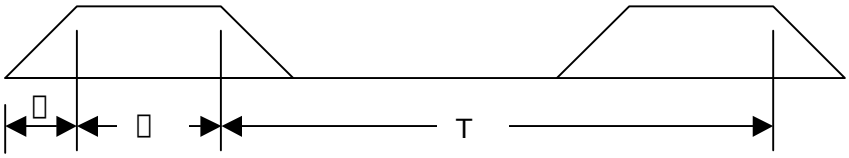

Figure 2 – LED Transitions

- Green LED – Synching
- Blue LED – Encounters
- Orange LED – Recording
- Orange/Green LED – Power

Synching refers to the period after a metabadge has encountered a metabadge-aware device, and initiated synchronization, called an "airsync" in metabadge lingo. Airsync operations include data exchange regarding time, sounds, appointments, reminders, and other file transfers. During airsync, the LED pulses for 250ms at a period of 10 seconds.

The airsync LED begins pulsing only after it has been determined that new information is available since the last airsync operation, and pulsing ends once the device is in sync. This provides a visual indicator to the wearer when airsync is running, and when it has finished. Since airsync may be initiated every few minutes, this protocol also prevents suggesting the device is out of sync when it is really just verifying that it is actually up-to-date.

Encounters relate to discovery of a metabadge-aware device (such as a PC, or another metabadge). During an encounter, the blue LED pulses for 250ms at a period of 30 seconds[3].

During audio recording, the orange LED pulses for 100ms, at a period of 15 seconds.

[3] A result of this protocol is that during an airsync operation, the wearer can expect the blue LED to pulse while in contact with the pc, and the green LED to also be pulsing, during airsync update.

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The orange power LED begins to pulse when approximately 30 minutes of normal operation is left in the battery. Normal operation is the standard operating mode of the metabadge, which corresponds to power-saving mode, with regular period of wakeup to make Bluetooth inquiries. Activities that use additional power, such as audio recording and playback, LED activity and airsync reduce the remaining time according to their power draw.

The orange power LED glows continuously while the metabadge battery is being charged then goes off when fully charged. The green power LED glows while the charger is plugged in and the battery is fully charged.

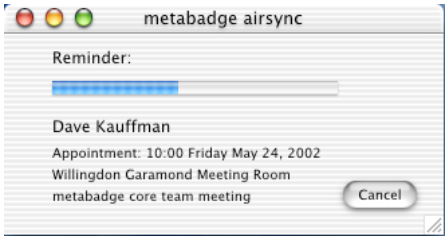
Metabadge control panel

The metabadge control panel (mcp) is an application that performs two separate functions: it provides a user interface to control the settings of a particular metabadge, and it also provides a background service that detects metabadge devices, and synchronizes.

Mcp is a memoryless[4] application, which means that it does not store information across synchronizations. Being memoryless has several benefits:

1. Any metabadge can be synchronized by any mcp so that wearers do not have to return to their pc to get synchronized.
2. All the information required to synch the metabadge is on the metabadge itself, so it can update itself from any mcp.
3. In a meeting room with several metabadge wearers and one networked pc, all metabadges will get synchronized via the one pc.
4. metabadge knows when it last synched, so can instruct any mcp where to begin from in terms of synchronization time.

Apple's iSync application uses SyncML to align contact information and calendar events between PC and phones/PDAs.



When in background mode, mcp displays this dialog once it detects and begins to synchronize a metabadge, showing the owner, and the download event.

[4] The exception being that mcp saves one default metabadge id which is the one it attempts to connect with when mcp is opened in foreground mode. The user can still select another metabadge.

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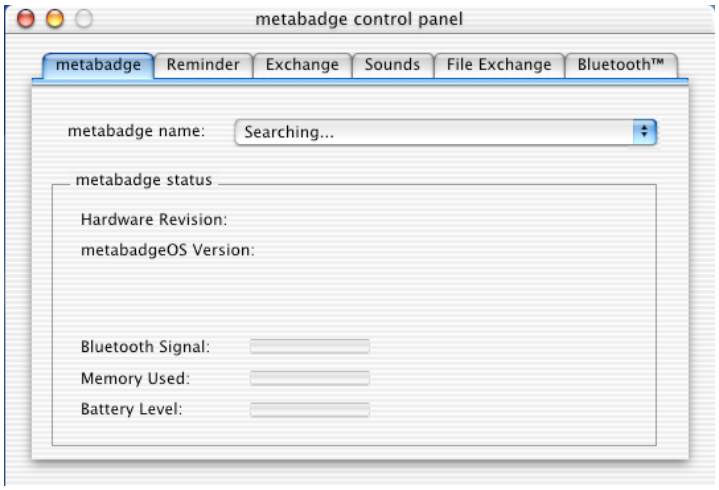
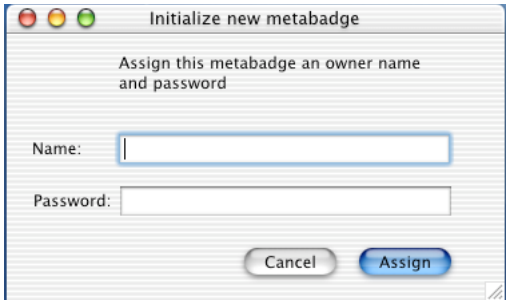
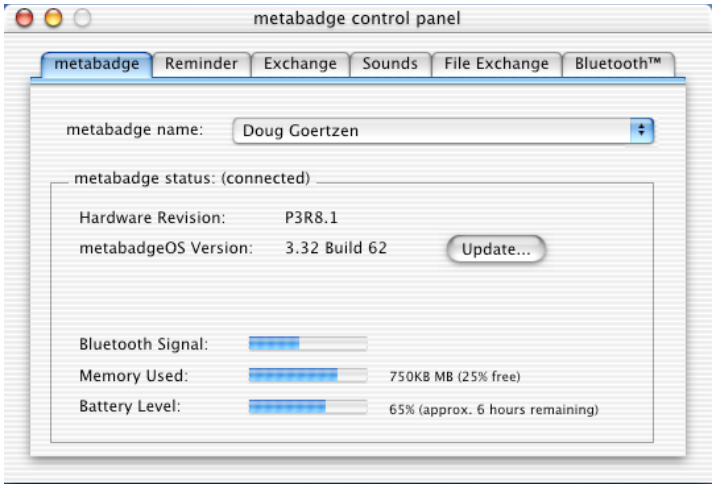


When the mcp main window is opened, by selecting the mcp icon, it searches for metabadges in the vicinity, and makes the user choose one to update. Users only open the mcp window to alter metabadge parameters, which should be rarely (once a week), as the airsync is designed to be automatic and require no user intervention.



A new metabadge needs at least a username and a password to continue.



After an inquiry, mcp determines which Bluetooth devices are metabadges, and displays a popup for the user to choose the named metabadge. Greater security will ask for a password here as well.

Hardware revision and metabadge os version are displayed. MOS can be updated over the Bluetooth link.

Signal level is as seen from the metabadge, remaining memory and battery are supplied from metabadge

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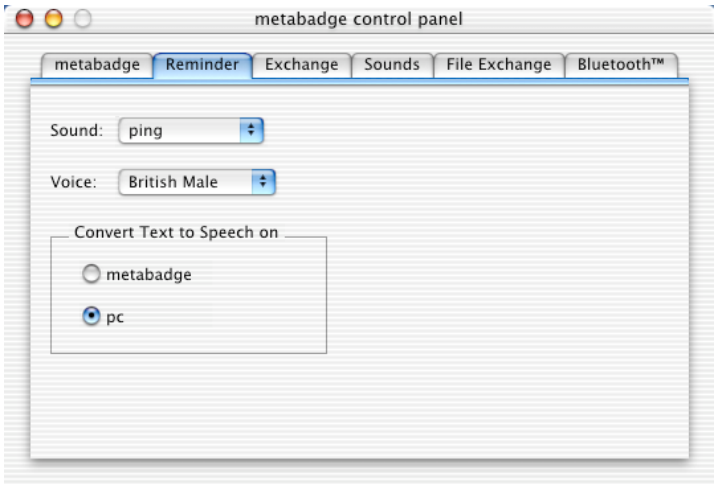
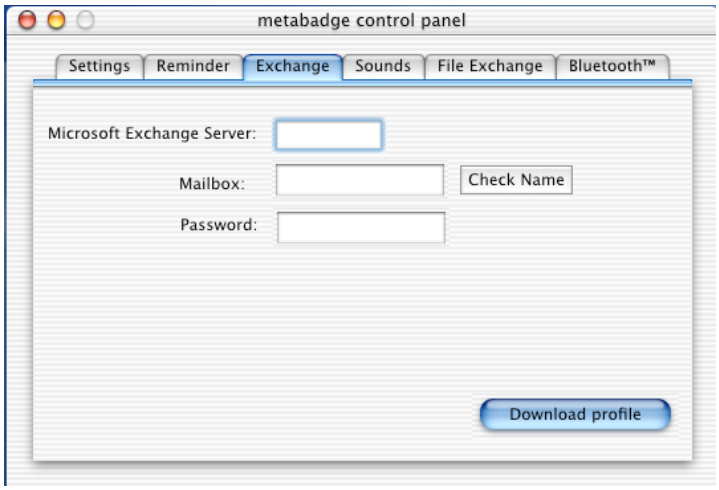


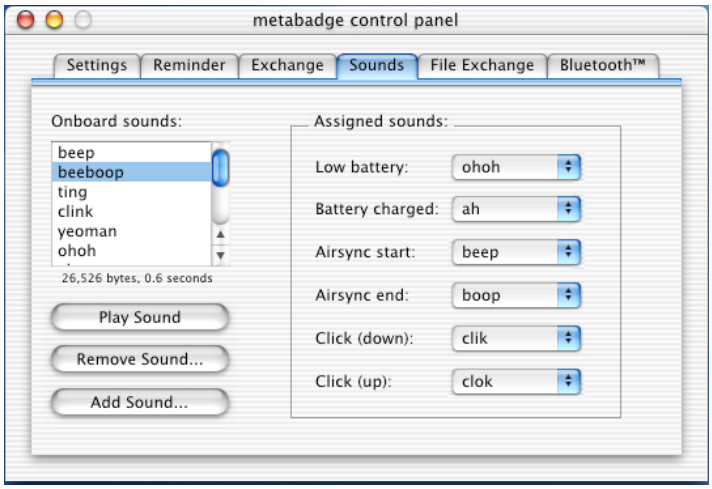
The reminder application tab:

Choose a reminder sound from those available on the metabadge. Choose a synthesized voice to use. May support text-to-speech on the metabadge itself, or preconvert it to wav on the pc. PC generated sound may have higher quality but take longer to sync, since it downloads wav files.



Information sufficient to allow mcp to connect the the metabadge wearer's Microsoft Exchange account and synchronize reminders and todo items.

Mcp uses this information to log into Exchange. Download stores this information on the metabadge.



Mcp controls the sounds available in the metabadge. Double-click a sound in the list to have the metabadge play the sound.

The Add and Remove sound buttons perform these actions immediately, which initiate the message and file transfers. These operations are threaded so that the user can go to other tabs or another application and the sync continues.

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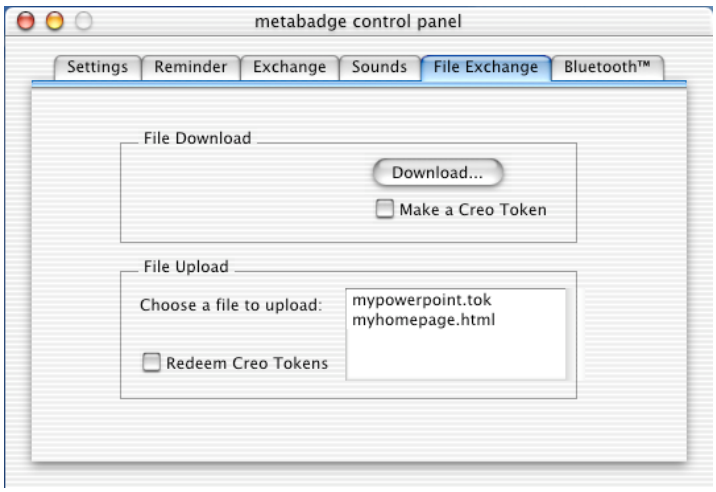
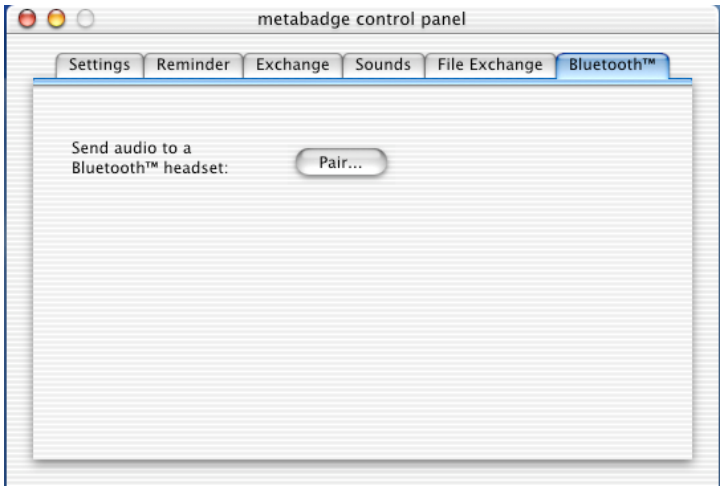


Metabadge supports file download and upload, including the ability to create tokens and redeem them.



The Bluetooth™ headset support requires "pairing" before audio can be routed to and from it. (Ed: how do you unpair it?)

metabadge applications

reminder

Reminder is a memory-assist application that lets the wearer know of things they are supposed to remember, at a time and place appropriate to being reminded. The simplest reminder is an **appointment**, which is a **time**-based reminder. An appointment includes a starting time, duration, name, and location. It may optionally include the names of other people expected to attend, and how far in advance you want to be reminded of the appointment. Appointments are downloaded from Microsoft Exchange, Palm Desktop, or Apple's iCal. Reminder downloads the next 24 hours of appointments whenever the metabadge can airsync.

Reminder has another kind called an **encounter**, which is a **proximity**-based reminder. Since metabadge can discover other metabadges, it can use the fact that it is in proximity to another one to remind the wearer of actions or to-do items appropriately. Placing a metabadge in a meeting room makes it possible to use the fact of being in a particular room a key to retrieve reminders. For example, I might set an encounter to remind me to look for my coffee cup next time I am in a certain

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conference room, or to remind me to tell Frank I have some pictures to show him next time I see him.

Interface control model for reminder

When reminder wakes up for telling the user of a reminder event, it becomes the selected application, i.e. it acts as if the user had used the application toggle to move to the reminder application.

When it is the selected application, the toggle button follows the user interface guideline and becomes the play/pause command. The reminder that gets played as the "current" appointment is available between the time of the reminder ("n" minutes before the appointment) up the next reminder. The scrollwheel is the next/previous appointment selector. Metabadge calculates the rate of spin of the scrollwheel to determine how far back/ahead in time to select a reminder from. Once the scrollwheel has not been moved for 300msec, metabadge plays the time of the then current reminder. Pressing the "play" button then plays out the entire reminder, i.e. title, location, etc.

memo

The memo application makes use of metabadge's onboard microphone to record audio segments, and airsync them with your pc. As a basic feature, airsync places the digital recordings on your computer for later use. More advanced memo functionality allows the metabadge wearer to set a category for any recording, such as a To-do item, an email or voice-mail, or a reminder event. Choosing kinds of memos is achieved using a limited voice-command recognition system resident on the metabadge.

When memo airsyncs with its home pc, voice streams are passed through a speech-to-text convertor. The resulting text and audio file are attached and are both available on the pc. When the speech recognition identifies an email, it composes the text into an email ready for sending, while a reminder event creates a todo item.

Interface control model for memo

When it is the selected application, the play/pause button becomes record/pause. Pressing record starts recording and initiates the led flashing to indicate recording. Pressing and holding the toggle button down for more than 1 second in any state of the metabadge selects the memo application and begins recording a new memo.

Metabadge signals audibly with a warning tone when the available storage is filled and can longer record additional audio. The recording LED does not flash unless the recording is being saved to non-volatile storage.

The scrollwheel is disabled during recording, ie. It has no effect until the recording is paused. Scrolling moves forward and back in the recorded memo list. Once the scrollwheel has not been moved for 300 ms, metabadge begins to play the selected memo. Scrolling while a memo is playing immediately stops playback of the memo.

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If the user presses the record button, metabadge appends the new recording to the current memo.

Successful airsync of memos to the users PC causes the metabadge to erase them from its memory.

Mini-conference phone

Conference phones are usually large table-based speaker-phones, sometimes with satellite microphones to be near the speakers. Even through the signal processing can be very good on today's devices, users end up moving around, speaking inappropriately loudly, or having to sneaker-net microphones around the room. Metabadge mini-conference uses the Bluetooth headset profile to appear to be a headset to a Bluetooth-enabled cell or land phone. Once that is established, metabadge uses the personal area network to enable other people wearing Bluetooth-enabled headsets to join in the conference call, performing the signal processing locally on its Digital Signal Processor (DSP). The improved quality of digital radio, and each person having a unique microphone and headset greatly improves the quality of a collaborative conference call.

Time Tracker

In many industries, ranging from prepress to legal, staff need to track their billable hours and which accounts to bill against. Many applications have been developed to assist this bookkeeping effort, but metabadge has an advantage in always being with the wearer, and being able to use proximity technology to infer additional context for the wearer's activity, either by location (library, conference room, in front of their computer) or by proximity to a person. By recording audio from the wearer as converting the speech to text, metabadge can create a log of activities and time spent.

Door Security System

The passive resonance keycard entry system has been the mainstay of door security for business for many years. Metabadge offers a clear advantage for door entry systems over keycards: distance. Since Bluetooth distance can be 10 metres, there is less waving of hands to find card sensors or putting packages down to find the card.

Book Crossing.com™

Book crossing is a "a global book club" that tracks books and encourages people to leave books that they have read and no longer want, in public places for someone else to pick up and read. The web site supports book tracking and reviews.

Metabadge can facilitate projects like this by storing available titles, and items being searched for in its own memory. By using the proximity technology available with Bluetooth, metabadges can examine lists and match books available with books being searched. By signaling the wearers, both are made aware of a possible trade.

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Metabadge user personae

This section describes characteristic of metabadge's target users.

Michael – Retired CEO

Michael was the CEO of Murphy Concrete and Gravel, where he rose to CEO after working his way up from draftsmen. Now that he is retired, he finds himself busier than when when he was working, as speaking engagements and consulting take up much of his time, along with volunteer efforts for the local community building projects. He received a Palm V from his son a few years ago, but now finds the print too small and low contrast to be useful. He thinks technical things are fine is they "just work" but has little patience for "finicky gizmos"

Margaret - Veterinarian

Margaret just opened a veterinary clinic, achieving a long-term career goal. With such a small office, the receptionist also manages the office, phone, clients, and babysits animals and kids in the waiting room. Margaret would like to have an appointment reminder system but it has to be handsfree, and be with her wherever she is in the office, and no matter what her hands are covered in.

Bruce – Disabled Office Worker

Bruce works in the print and mail section of an office building where he manages the print center's Docutech, as well as sorting internal mail. Bruce's mental disability is best supported by having a regular routine, but he has several meetings per week he needs to attend, but has difficulty remembering to check the time each day.

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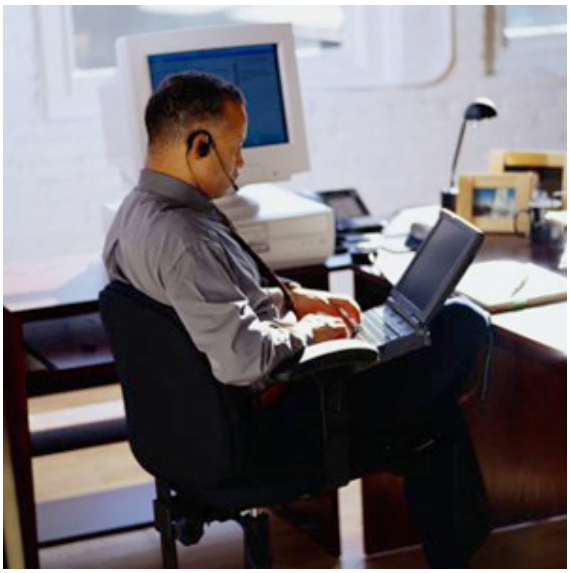
Blair – Sales Associate



Blair has a B.S. and is working in the evenings on his M.B.A. He thinks technology is a tool to squeeze every minute of productive time out of the day. Blair is not a workaholic, he likes to spend evenings with his girlfriend, and weekends sailing with firnds, but he likes to be reachable, and wants to connect to the office anytime during the day.

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Metabadge stories

Mcp installer

Mcp detects metabadge

Metabadge finds metabadge

Mcp sets metabadge time

Mcp gets metabadge username

Mcp sets metabadge username/password

Mcp lists metabadge sounds

Mcp adds a sound (WAV) to metabadge

Mcp deletes a sound from metabadge

Metabadge plays a stored sound

Metabadge decompresses a stored sound and plays it

Mcp initiates airsync

Led control for airsync

Mcp checks metabadge version

Mcp sets metabadge time

Mcp queries remaining metabadge ram free space

Mcp queries remaining metabadge battery charge

Mcp queries Exchange username/password/domain from metabadge

Mcp sets Exchange username/password/domain on metabadge

metabadge recharges

metabadge led and sounds when recharge needed

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metabadge pairs with Bluetooth headset

metabadge downloads reminders from isync

Encounter from a Bluetooth cell phone

Record sound from microphone

LED control while recording

Store saved sound in flash

Upload saved sound

Mcp converts sounds to text

Metabadge recognizes keywork commands (memo, todo, reminder)

Mcp downloads appointments (reminder by time)

Metabadge plays reminder sound, time, topic, location, "reminder time" before the appointment

Mcp downloads todo's with person/location tags (reminder by proximity) from outlook

Mcp plays reminder when person/location encountered.

metabadge/mcp upload of memos

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