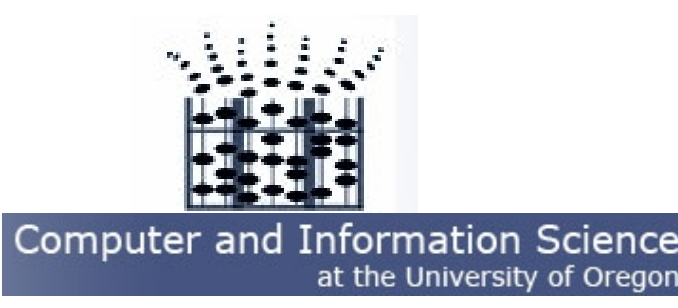




UNIVERSITY OF OREGON



DuckCall: Tackling the First Hundred Yards Problem

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Introduction

We set out to break the social-isolation problem faced by those with a cognitive impairment. In a background study [2], we have identified three main problems for traumatic brain injury (TBI) population: (1) trip planning, (2) using public transportation, (3) using the services at the destination. Our group is working on each of them.

In this demonstration, we focus on tackling the first problem, called the "first hundred yards problem". There are two basic problems related: time management and inventory management. We show a reminder system, dubbed *DuckCall*, that helps the users with both problems.

Design decisions

DuckCall is a system consisting of a content server, an intelligence device that is stationed in a home or apartment, a TV, and an optional travel bag. The TV is used as the main user interface in the apartment, with the reasoning that a TV has been a popular and familiar item in the TBI community [3].



Fig. 1. TVBox and SmartBox



Fig. 2. A snapshot of a domestic setup

The intelligence device consists of two components, a *SmartBox* that acts as the brain of the device and a *TVBox* that serves as the external interface to the user and the TV. Figure 1 shows a TVBox stacked on top of a SmartBox. Figure 2 shows a prototyping system, including TVBox (back), a PC as the SmartBox and a TV.

The TVBox has a simple two-button interface to catch user inputs. It also interacts with a standard TV: it has sensors to detect TV on/off status and volume level, an infrared (IR) receiver to receive signals from a remote controller, an IR emitter to control the TV, and an mixer to choose TV audio/video source (e.g. PC, antenna). The Smart Box is a PC wrapped in a set-top-box arrangement that allows zero maintenance and has no mouse/keyboard. For a user having a PC at home, the SmartBox can be replaced with his/her PC installed with DuckCall software.

Typical usage scenario

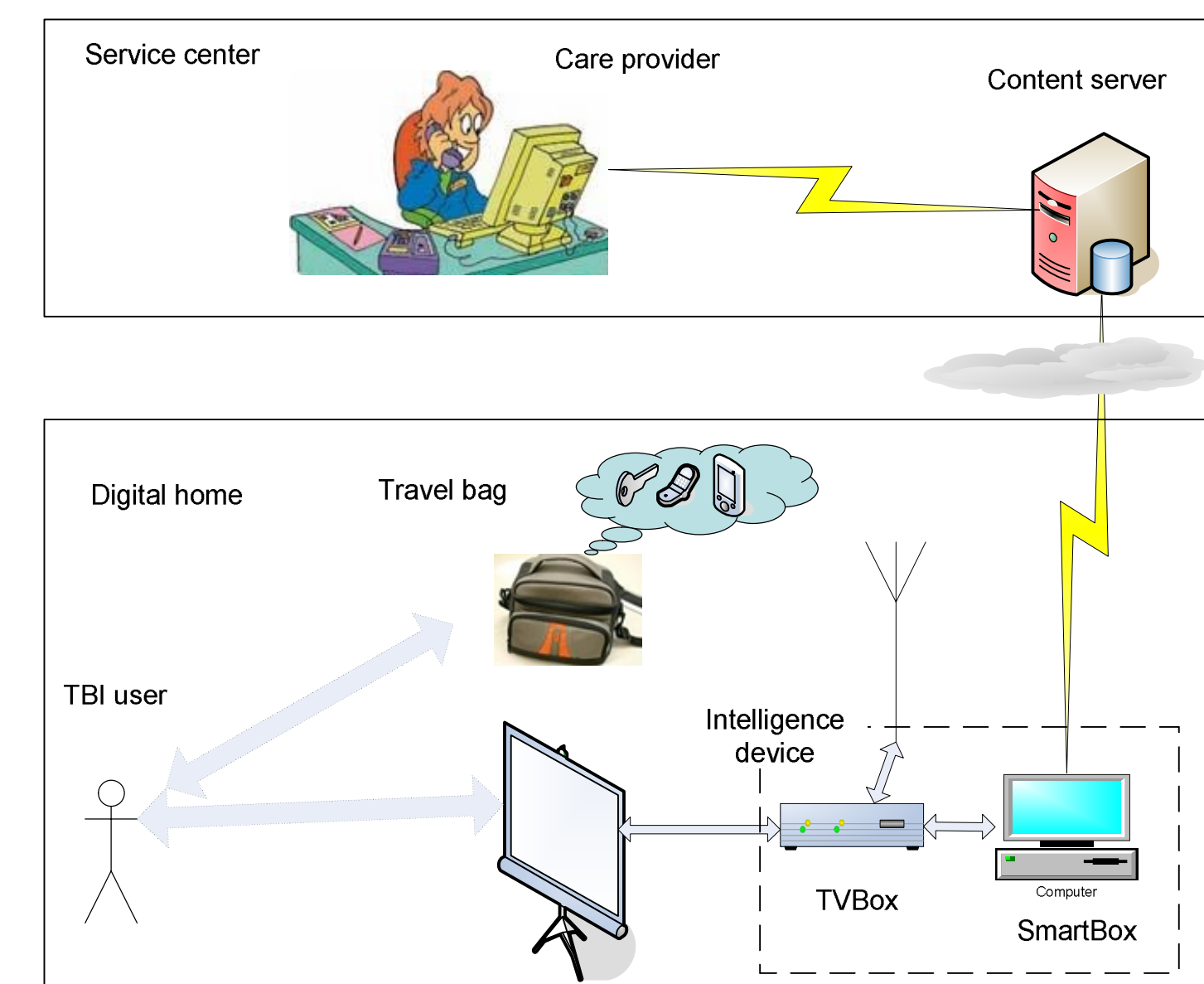


Fig. 3. Typical setup of the DuckCall system

Fig. 3 shows a typical setup of the DuckCall system. Mary is a care provider for several TBI users, including Nancy. She sets a reminder for Nancy for a weekly clinical appointment. She enters trip information via a web page, including appointment time, frequency and meds Nancy needs to bring. The reminder is delivered from the content server to the domestic DuckCall system. When an scheduled event is approaching, the domestic system will turn on the TV and play the scheduled reminder. Nancy is reminded with the appointment and trip items. She can tell the system that she is ready to go or needs further help via the 2-button interface.

Extending the concept



Fig. 4. Travel bag ties into the SmartBox

We are developing a travel bag that can assist users before and during the trip. A prototype type of the travel bag is shown in Figure 4. The travel bag is facilitated with RFID detectors and an embedded wireless controller, to be integrated with the DuckCall system. For example, Nancy needs to carry her pills and bus pass in the trip. The travel bag can detect what items are missing and inform the SmartBox, and the SmartBox will play proper contents to remind Nancy about the missing items in the TV.

System architecture

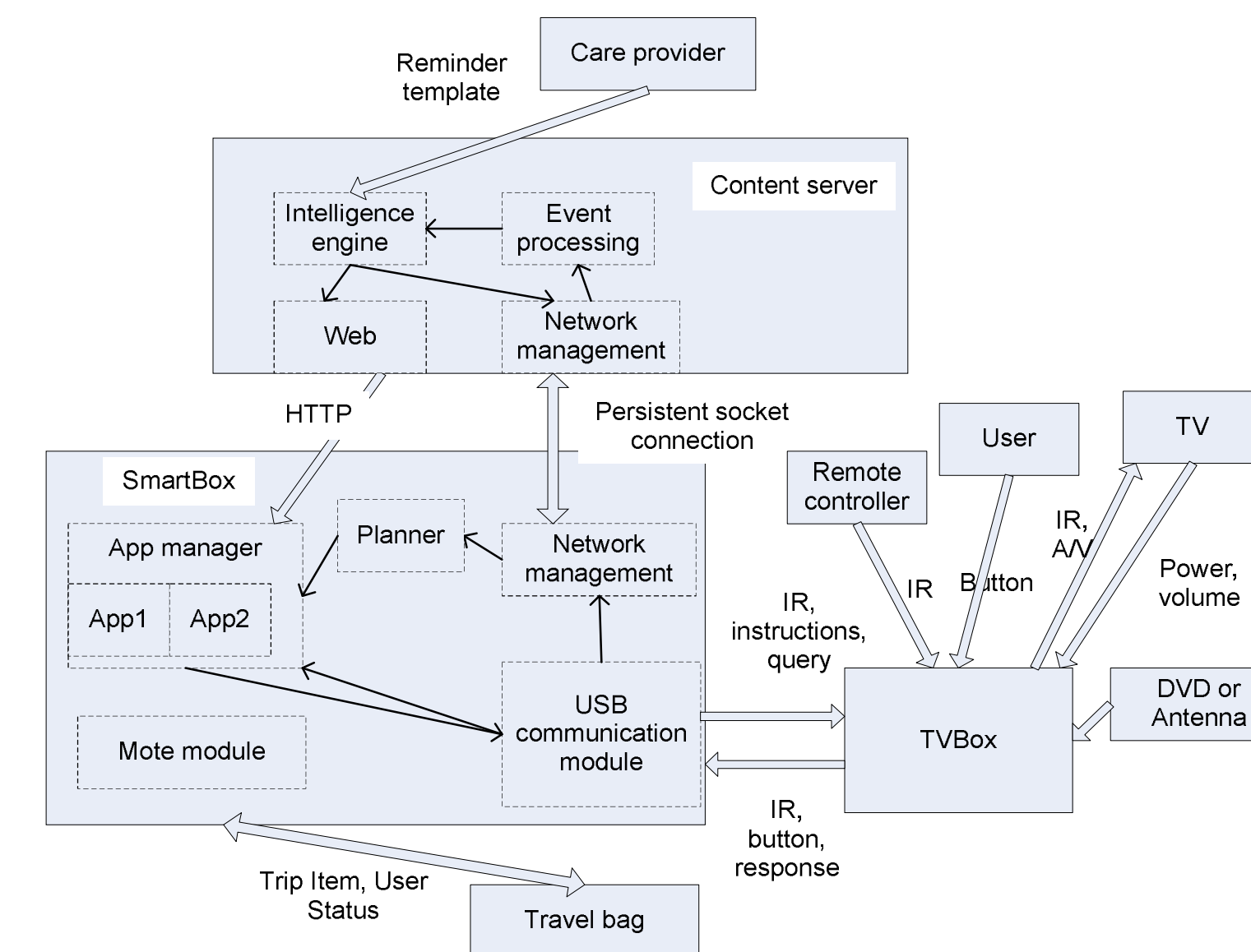


Fig. 5. Software components of the DuckCall system

Figure 5 shows software components of the DuckCall system across platforms. The *SmartBox* is a multi-threaded reactive system in Java. It has a dual-connection (a persistent and a volatile connection) to assure timely delivery without constant polling. A *Planner* queues incoming reminders and selects a ready reminder with the highest priority. A reminder is described in an XML-based domain-specific language. An *Application Manager* interprets the XML description and plays the proper content. The *Content Server* has web-based templates to assist a *Care Provider* to specify a reminder. It also keeps track of events from all *SmartBoxes*. This will be used by an intelligence agent, e.g. to form Special Interests Groups among the TBI community.

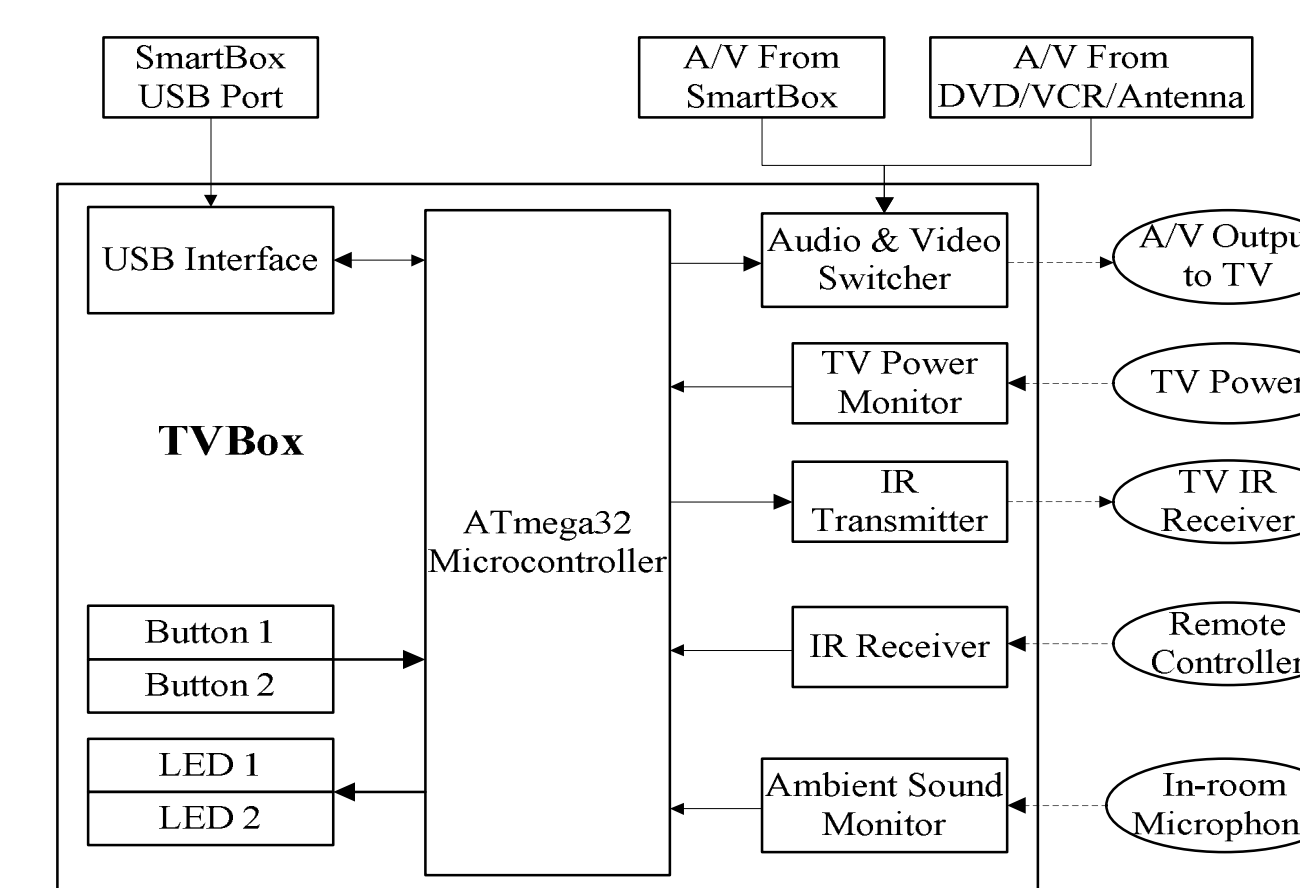


Fig. 6. Hardware design for the TVBox

Figure 6 shows hardware connections for the *TVBox*. It has an ATmega32 microcontroller as the brain. The SmartBox VGA video is converted to composite using a commercial adapter. We design a relay network (controlled by ATmega32) to select one A/V signal from all sources. A current sensor measures power consumption rate to determine the TV status (on, off, unplugged) after calibration. Similarly, there is a noise sensor to detect volume level. Through the USB interface, it receives instructions from the SmartBox, periodically reports TV status and immediately reports user inputs. The control software is written in C and compiled using GCC for Atmel devices.

Conclusions

Our group is interesting in breaking the social isolation of TBI community. The DuckCall system is designed to help them to start the trip on time and with needed trip items. A preliminary dayroom study in an institution in Eugene, Oregon, shows the acceptance of the DuckCall system by TBI population. To our best knowledge, there is no similar reminder system for the TBI community.

We have found that non-functional requirements are critical in the specific domain. In particular, we design the DuckCall with the following features:

- *Ease of usage* The TVBox has extremely simple user interface, and the TV is a familiar item.
- *Affordability* A commercial version of the TVBox costs \$200, and a SmartBox \$350. The SmartBox can be replaced by an existing PC to further reduce the cost.
- *Low operational cost* Help through a web interface costs much less than helping a user on the spot. Also, the system needs "zero maintenance".
- *Extensibility* It is designed with future variations in mind. For example, the Application Manager is an extensible XML interpreter to accommodate new devices.
- *High availability* It is tolerant to a certain failures. For example, it has a TVBox emulator as a runtime monitor to early detect state inconsistency, and it self heals for a broken Internet connection.

Literature cited

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For further information

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