FamilyFlower: an Artifical Flower to Foster Distant Family Connections

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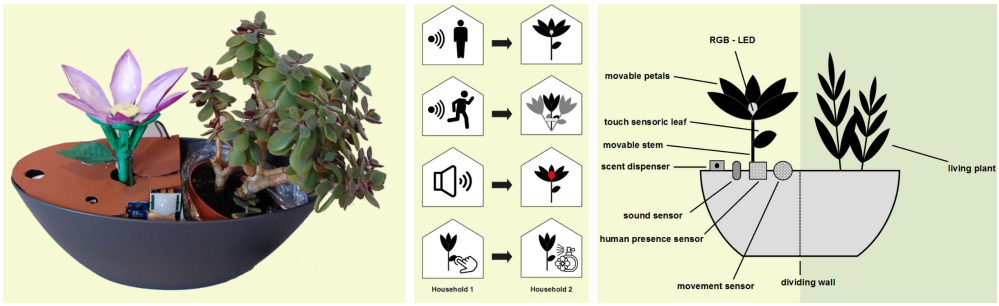

Fig. 1. The FamilyFlower Prototype (left), its implemented senses and communication channels (middle), and a technical sketch (right).

Modern, globalized lifestyles make physical separation of family members an inevitable part of life. Due to changes in routines and social roles, remaining connected to distant loved ones is challenging and adversely affects psychological well-being. To support relatedness, we created FamilyFlower, an artificial flower aimed at fostering a connection between remote households by bringing awareness of everyday activities and offering basic expressivity. In its environment, each device detects human presence, movement, sound, and touch. In the remote household, the paired prototype responds by respectively opening the flower bud, actuating the stem, altering the seeds' color, and dispensing a fragrance. In a 2-week study of deployment between 2 family members, we collected initial impressions of our prototype, and identified key aspects our system could support in future research. From our results, we see that FamilyFlower supports an awareness of ongoing activities in a distant household and built a feeling of connectedness.

CCS Concepts: • **Human-centered computing → Human computer interaction (HCI)**; **Ubiquitous computing**; **Ubiquitous and mobile computing systems and tools**.

Additional Key Words and Phrases: ambient interfaces, internet of things, empathic living media, connectedness

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1 INTRODUCTION

A feeling of closeness or connectedness to family members is fundamental to an individual's happiness, academic competence, and personal development [12]. However, modern, globalized lifestyles contribute to disconnected family bonds as their members are more likely to live remotely from each other. This physical separation negatively impacts a family's physical and emotional health as the created distance disrupts communication, which may cause feelings of exclusion or loneliness. Even with the help of current technology, the effort of maintaining a strong connection remains challenging due to asymmetries in personal routines or individual inclinations to use technology [3].

Mediating a feeling of relatedness with significant others, demands technology to move beyond explicit information exchange by building interfaces for subtle communication aligned with our social nature. Prioritizing such meaningful and positive experiences over basic functionality supports well-being [9]. In our design approach, we focus on nurturing a feeling of closeness through awareness of a disconnected household's activities in terms of human presence, movement, and sound level, and by offering basic expressivity. This builds upon existing work of nurturing long distance relationships [8, 13]. We involve the field of living media interfaces which ranges from various levels of information displays [2, 5, 7, 10, 11, 16] and display-enhancing artificial plants [4, 6], to integrated biological HCI [14, 15].

As ubiquitous and prevalent parts of our environment, plants have positive effects on an individual's well-being and have been shown to incite human affect for them [1]. Motivated by this, we built FamilyFlower, an artificial flower aimed at fostering a connection between remote households by bringing awareness of everyday activities and offering basic expressivity. Built into one half of a plant pot with the other half holding a real plant, the flower symbolizes ongoing remote events. In its environment, one FamilyFlower device detects human presence, movement, environmental sound level, and explicit touch of a leaf, see Figure 1 middle. These are then communicated to its paired counterpart in the remote household which responds by respectively opening the flower bud, moving the stem, altering the flower's seed color, and dispensing a scent using a fragrance dispenser. In a 2-week user study involving two households, we collected participants' initial impressions and aimed to identify key aspects our system could support in future research. From our results, we see that FamilyFlower supports an awareness of ongoing activities in a distant household and built a feeling of connectedness. Participants indicated positive experiences with the device, noted the device's functionality of "sending messages", and stated it served as an incentive to further communicate with each other.

2 THE FAMILYFLOWER PROTOTYPE

Each FamilyFlower prototype is built into one half of a plant pot, with the other half serving as a space for a real living plant improve the aesthetic integration of the prototype with its environment and to draw attention from its owner to be taken care of. As a connected input and output device, each device senses four different activities in its environment and communicates the detected state with its paired device in the remote household. Firstly, human presence is detected using a human presence sensor (AK9753) and is represented in the remote household by opening the flower. Next, active movement is detected using a PIR infrared motion sensor (HC-SR501) and is represented by actuating the stem of the flower. Furthermore, the ambient sound level of the environment is analysed using a KY-037 microphone sensor module and is visualized by changing the color of the LED inside the flower bud (< 35 Db, blue; 35 Db < x < 70 Db, red; > 70 Db, green). Lastly, a capacitive sensor on the leaf of the flower communicates direct touch by dispersing a fragrance in the environment through actuating a servo motor pressing a fragrance dispenser.

Table 1. Averaged, daily number of environment events picked up by either plants during the course of the 14-day study.

	Household 1	Household 2
Human presence	315.14	138.57
Movement	463.86	571.57
Sound middle	5.14	5.21
Sound loud	0.43	0.29
Touch	1.36	1.57

A technical overview is depicted on the right hand side in Figure 1. All hardware is controlled using an ESP32 NodeMCU wifi-enabled micro-controller, with actuating parts driven by MG995 RC Servo motors. For data communication, we used the ThingSpeak[1] platform, with each device connected to one write channel to store the device's state and one read channel to read the state of its paired device using 16 seconds intervals.

3 EVALUATION

For an initial user study, we recruited two participants with an intimate family bond, both female, both aged 26 years old. Participants lived disconnected in their own apartment. Here they spent between 8 and 11 hours per day on average during weekdays, and between 12 and 16 hours on average during weekends. Each participant shared their environment with another person who also had access to the device and in one of the households lived a cat. Participants indicated to connect with each other several times per week using other media, e.g., by texting or calling.

The study was carried out during a period of two weeks in which one FamilyFlower prototype was installed in each household and paired with the other prototype. Participants were allowed to choose the location of their device, and respectively did so in the kitchen and on a coffee table. After the study, individual semi-structured interviews were conducted to assess which functionalities were actively used, if participants were able to recognize the device's behaviour and how they reacted to these indications. Lastly, participants were asked to assess if the device influenced their feeling of connectedness with the other participant and if their relationship and mood changed during the study.

4 RESULTS & DISCUSSION

To analyse interaction times and events using the FamilyFlower device, we used the recorded communication data from the ThinkSpeak platform. In terms of picked up environmental events, the readings indicate that all functions, excluding touch, were triggered on a daily basis in both households. The touch functionality was used 9 days out of a total of 14 in one household and 10 days in the other household. The averaged event count per functionality per day is shown in Table 1. Furthermore, the results indicate the device was used more often during the 6am and 22pm period. Peaks in human presence and movement detection occurred during the morning sessions between 6:00 and 8:00 (human presence, 23.98%; movement, 17.84%), while the touch functionality was more clearly active in the afternoon (14:00-16:00, 21.95%) and the evening (18:00-20:00, 26.83%).

Both changes in flower state and stem movements were noticed multiple times during the day, partly due to the sound of the servo motors and the movement of the components. Participants indicated they would on a regular basis respond to these events by approaching the device and triggering a counteraction, e.g., by touching the leaf. This

[1]IoT Analytics - ThingSpeak Internet of Things - https://thingspeak.com/

underlines the need for an explicit communication channel. The change in flower color and fragrance dispensing were indicated to be less frequently noticed. Such events were responded to by tapping on or blowing into the microphone.

Both participants reported to feel an increased connection with each other, and a positive change in their relationship. The reasons for this were an increased awareness of each others' routines, and an indication of having more contact to each other. They organized virtual coffee meetings supported by our prototype. A positive change in mood was supported by a feeling of happiness when the flower was moving and a feeling of excitement to use the device to connect to each other. Participants indicated the device stimulated them to further connect to each other through other media, such as texting or calling. This shows our concept can serve as an additional channel for family connections.

Participants indicated the device integrated well into their daily lives. One participant specifically liked the connection to a known person and underlined the device's capability of "sending of messages" by waving to the plant to actuate the remote flower stem and touching the leaf to trigger the remote fragrance dispenser. The other participant appreciated the design of the artificial flower and its petals, the variety of functions the device offers and the concept of mirroring the events in the connected household. Both participants criticized the unpleasant smell of the perfume. Furthermore, one of them wished for a more precise microphone.

5 CONCLUSION

In this work, we present FamilyFlower, an artificial flower aimed at fostering a connection between remote households by bringing awareness of everyday activities and offering basic expressivity. The results of a 2-week study between 2 family members underline that our prototype supports an awareness of ongoing activities in a distant household and builds towards a feeling of connectedness. The functionality offered by the device allowed participants to create a small conversation with each other and provided an incentive to further connect. In future work, we aim to extend the current work by pairing more households together, and intend to perform a longitudinal study to investigate interaction patterns and routines that arise from supporting distant communication between households.

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