Managing Alzheimer's using app Technology

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Problem description

The problem is simple and commonplace. An ageing Mother, living alone in the family home is suffering with Alzheimer's disease. Her condition is relatively mild; she can live alone in safety if someone visits once per day and someone stays over at the weekend. The family can manage this level of support. However her condition is increasing in severity. The family is becoming increasing worried about their Mother. They have increased the level of daily visits and the strains and stresses in keeping up with the weekend stay over rota are beginning to emerge. No-one wants to see the Mother go into a home, least of all the Mother herself. Nonetheless the situation is becoming more difficult day by day.

To maximize the time spent living at home alone with Alzheimer's

Strategy and plan of action – desired outcomes

To extend the amount of time the patient could stay at home it was decided to try putting a camera into the house in June 2012. It was hoped that the camera would help with a number of items:

- To monitor who visits during the day (The patient lives in a rural area. There is a concern that someone calling to the door could take advantage of the patient's dementia and gain easy access to the house)
- Checking to see if she is awake and up
- Checking to see if the back door is open
- If a camera was in place the four daughters could check up on their Mother and gain some peace of mind and also decide if an immediate visit was required.
- It was felt that the camera must be visible via a mobile app because just one daughter lives in the Mothers hometown and the others are living further away and everyone is working and busy with their own lives.

When the family started to think about installing a camera there was simply a general sense that a camera was needed. A semi formal process of writing down a list of expectations was very useful. Writing a list helped to reflect on the real concerns and explore what the desired outcomes might be.

Write out use/service level expectations for the camera. Reflect on what is the real concern.

Technical requirements

The list of use/service level expectations led to the preparation of a specification sheet of technical requirements: The camera should:

- Be easy to install, just plug it in to the LAN and switch on. There should be no opening ports or configuring routers or creating Dynamic DNS tracking accounts or other technical fussing about.
- Be secure and private
- There should be no DVR in the house to go wrong or to hack or rob.
- Be fault proof (If the camera is accidentally switched off it should fully self restore when switched back on at the power switch)
- Show high quality live streaming – even in low light (have a light switch)
- Be accessible to each of the four daughters
- Have motion detection capability
- Be able to record motion detection events
- Be able to view live and recorded video via web and mobile
- Not look too much like a surveillance system

A solution was deployed as follows:

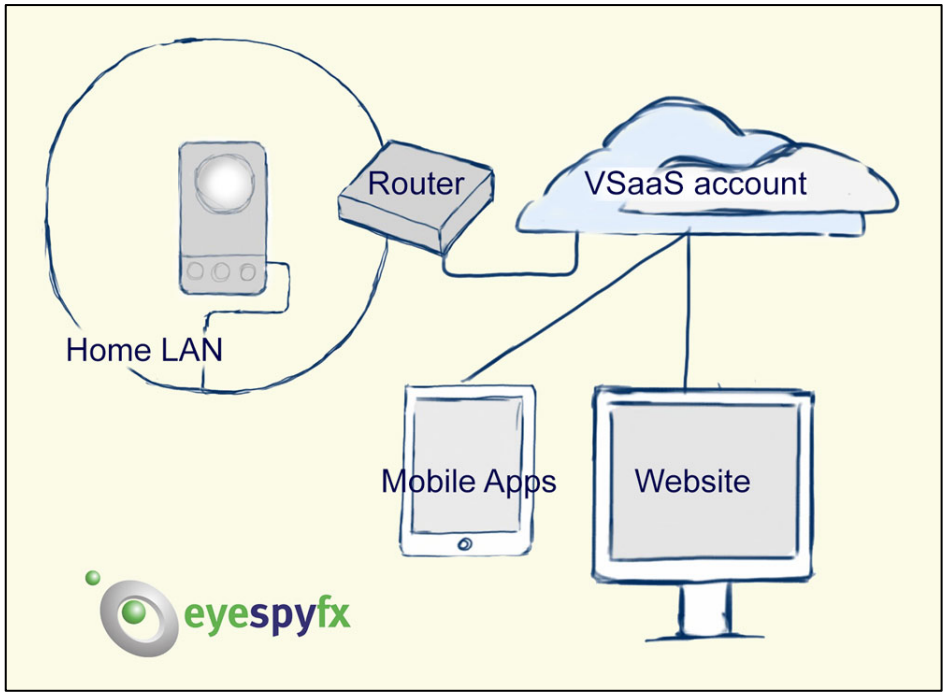
An AXIS M1054 Network Camera	£325
A Network cable	£25
A router	already in home
An Internet connection	already in home
A VSaaS account (Cloud access and storage)	£10 per month
VHS Viewer for AXIS mobile app on iOS	£6 per app

Ease of installation and operation – introducing VSaaS

There are thousands of camera systems on the market. They are not all the same! There is huge variation in price and quality with an emphasis on ease of installation and operation. The availability of high quality mobile apps led to investigation of Video Surveillance as a Service (VSaaS). Beyond the Mobile Apps there are many other advantages to VSaaS. With a VSaaS system the camera connects to a service in the Cloud. People viewing connect to an account in the Cloud rather than connecting directly to the camera. This means that initial set up is very easy. Router ports do not need to be opened. The camera has a one click connect button and a unique number that identifies it to the service.

The recorded video is not stored on the camera or in a DVR in the house. Instead the recordings are stored in the cloud. There is very little to go wrong or tamper with. If the camera is temporarily unplugged or switched off the service is automatically restored when the camera is switched back on. The VSaaS system is relatively expensive, but it works well and offers reliable, secure service.

Use a VSaaS based system – its easier and better.



General arrangement of system as deployed in the patient's home

Location of camera

The initial location proposal for the camera was the back door porch. However after further consideration the camera was placed in the hallway on the telephone table because it involved the least amount of cabling; the telephone table is also the location of the router. It was felt that this would be a good temporary location while the service was being tried out and tested before the more permanent task of running cables to the back door was undertaken. However the hallway turned out to be a perfect location. The house is a bungalow. The hallway is the central part of the house. All traffic in the house passes through the hallway from kitchen to sitting room to front door to bedroom to bathroom. The hallway location offers the ability to understand activity in the house without intruding too much on the private matters that happen in rooms.

Put the camera in non-private central space –like a hallway.

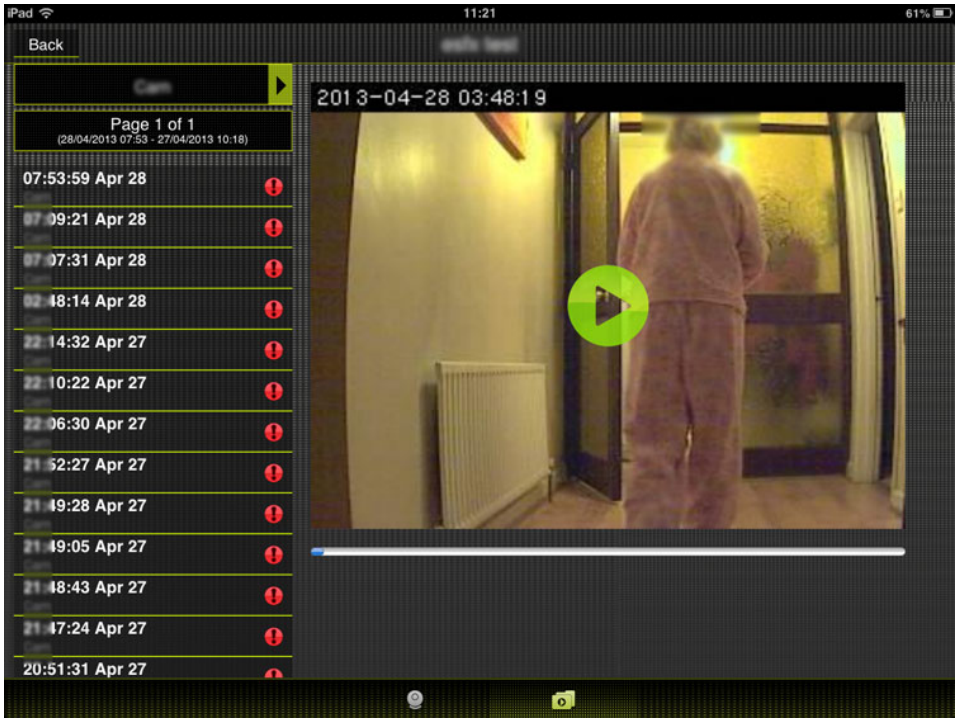
- *Good for activity monitoring*
- *Good for keeping privacy intrusion minimal*

Live view on iPhone

Mobile apps

The primary way that the family accesses the camera is via powerful mobile apps. The main advantage of the mobile apps is that the patient can be checked from anywhere, in a couple of minutes, while queuing in the supermarket, on lunch break or wherever there is spare minute. The process of checking is personal and private because it is done using a personally owned phone or tablet. Having the ability to get instant access anywhere, anytime provides a real sense of peace of mind.

Mobile apps enable quick easy access.



Recordings view: A reasonable night, just one disturbance at 3.48am (iPad Mini)

Motion detection

The camera looks toward the front door, which has glass panels. Changes in light outside, perhaps a passing cloud triggered the camera to make a motion detection recording. Lowering the motion detection sensitivity reduced this.

There are two dogs and a cat in the house. Making just the top half of the image active for motion detection reduced the chances of the family pets triggering the motion detection. It took a little bit of experimentation with motion detection settings

and view selection to get the set up right. Very ordinary practical issues came to the fore, like the two mentioned above.

Know what you are looking at

Pattern matching and activity deduction

Because of the central position of the camera in the house the patient causes up to one hundred motion detection events per day. Most probably an individual motion detection event is not significant but the pattern of motion detection events enables activity levels to be deduced, even without looking at the recordings. For example:

- Recordings stop at 22.30 > patient has gone bed
- Multiple recordings in the middle of the night > patient had a disturbed night
- Recordings start at 10.00 > patient has got up
- Recordings don't start until 13.00 > patient is depressed/upset/tired
- Looking at the last or first recordings in a group of recordings can also be useful for understanding activity: Recordings stop at 11.30. In this recording the patient was seen with her coat on leaving the house. This incident may be a cause for concern or it maybe fine.
- Recordings stop midday with the Dogs seen sitting at the front door > patient has gone out for a walk. Check to see if she has gone to visit the Daughter who lives nearby.
- Patterns of activity one day can be compared with patterns from previous days to deduce levels of activity on a weekly basis and detect unusual patterns of activity.

The Daughter who lives nearby is the primary weekday visitor. She checks the camera to see if her Mother has had a disturbed night of sleep and if she is up yet or not. She uses this information to help determine what time she should call in.

In the recordings view of the app there is a snap shot shown for each motion detection recording. By quickly reviewing the snapshots the Daughters you live far away can see that the near home Daughter has called in and everything is ok. That helps create peace of mind for the Daughters who live far away from home.

Patterns of motion detection recordings can be used to deduce activity types.

Critical incidents and more cameras

As the patient over time has progressively deteriorated into serious Alzheimer's the difficulties of living at home alone have increased. As this happened the camera has become increasing relied on as the Daughters have increased the level of visits and supervision. There are now new risks, for example: falls, accidental overdose, nighttime roaming, etc. Consideration is currently been given to installing more cameras. The new cameras will be installed in the kitchen and at the doors. This will impact privacy to a greater extent but may help to manage essential safety issues and extend further the time the patient can continue to live in her own house. Clearly, cameras cannot prevent the occurrence of a critical incident but it is felt that if deployed could help with speedy response. It is plain, unfortunately that the amount of time left where increased cameras can help is limited.

One camera is certainly useful to help manage gradual dementia, two may be better, and three could really help understand what is happening. There is probably some number (beyond this study) of cameras where if you need that many cameras the risk that you are trying to manage is simply too great for any number of cameras or any other technological interventions to really help.

If you need more than three(?) cameras the benefits may be outweighed by the risks. Cameras can be a help but not a cure.

Costs and Conclusion

The cost of deploying cameras is small compared with the cost of even a week of residence in a care home. The emotional and well being benefits of staying at home for the maximum safe time are invaluable to all family members. In this case study it was clear that the camera(s) and mobile apps certainly provided:

- Assistance in the management of care,
- Enhanced peace of mind
- Extended the time that the patient can stay at home

Cameras can help to extend living at home alone for Alzheimer's patients.