Iterative Deployment

A Method of Idea Generation through User Engagement

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Contents

Introduction

This project used an experimental design process called '*Iterative Deployment',* which built on existing literature about the deployment of ambiguous prototypes and user tool-kits.

To begin this process, members of the public were given a device with no specific purpose as a method of encouraging them to consider how this might be used and developed into a product that is relevant to them. This was followed by the designer interpreting there response, in order to build a working prototype that enabled them to test and improve their designs, or suggest completely new ideas. This method of working led to a vast array of design concepts from which *photoBot* was selected for development to an exhibition standard.

photoBot is an innovative alternative to 'point and shoot' photography. The product is designed to capture photos automatically by detecting the location of people using ultrasonic sound. While *photoBot* can be used in many situations, the principal scenario for selling the product is a party or family gathering. During a party the user will be able to take part in the occasion, safe in the knowledge that *photoBot* is capturing a series of photos for them. These photos range from unposed candid shots that reveal an individual's true character, to those of people who have noticed themselves in the screen and shamelessly played to the camera. As an autonomous device, there is no way of knowing what he is going to capture, which creates an element of surprise, intrigue and expectation when the user finally sees the photos.

photoBot

Includes a description of use, context photos, target market, aesthetics and an overview of *photoBots* features.

Summary

photoBot is an innovative alternative to 'point and shoot' photography. The product is designed to capture photos automatically by detecting the location of people using ultrasonic sound. While *photoBot* can be used in many situations, the principal scenario for selling the product is a party or family gathering. During a party the user will be able to take part in the occasion, safe in the knowledge that *photoBot* is capturing a series of photos for them

Using the Product

The user turns *photoBot* on and places him in a position that provides a good view of the room, most likely a table, mantel piece or shelf. The product then scans the room looking for people, if they are found it will take a photograph. Photos are saved to the SD card or uploaded directly to a social media site. Once the event has ended the user can remove the SD card, look at the photos on a computer and select those they like.

Aesthetics

photoBot was given a friendly appearance by using anthropomorphic features, such as a head and body and by composing the components to form a face. This effect has been enhanced by giving the holes for the camera and LED a filet that resembles an eye socket. The aim was to create a design that people like, by encouraging an emotional response (as discussed on page 26). This visual appeal is also likely to create a strong brand for the product. A white plastic has been chosen to create a clean and modern appearance that is unobtrusive if placed around the home.

Market

photoBot will have wide ranging appeal, though because of its focus on parties or events is likely to lend itself to a younger age group such as students or young professionals. These individuals will enjoy taking lots of snapshots, cherishing memories over a well composed, flawless photograph. There also likely to enjoy life-logging and sharing snaps with friends and family through social media sites.

photoBot will have an affordable RRP of £40 (as discussed on pages 38-39). As a playful gadget the product will retail in gadget outlets and stores such as firebox and red5. These companies are often first to sell new gadgets and have the type of customers who will adopt them early. The firebox company policy states that "Firebox scours the world, looking for the very latest gadgets, toys, games and other cool stuff" (Firebox).


happy b


awesome

Features

Camera

An LED that indicates wither the device is powered.

An ultrasonic ranger that detects a change in distance to the nearest object and therefore senses people.

An Oled screen that displays photos when they are taken. This gives the user a sense of what it is being photographed and encourages people to occasionally pose for the camera.

A circular cut out that allows the power cable to trail from underneath the device.

Initially the head of *photoBot* will move randomly through all positions within its full range. Once someone is detected and a photo is taken, *photoBot* will return to this location more often, to check if there's still someone there.

Features

Photos are saved to an SD card that is located on the base.

On/off switch

Socket that charges a battery and provides power if the battery is depleted.

User Engagement

Process

A brief discussion about **t**he research and development process proposed and followed during this project. This led to the *photoBot* concept.

Method Overview

Image 1:

The first device had a label that encouraged people to use it for something.

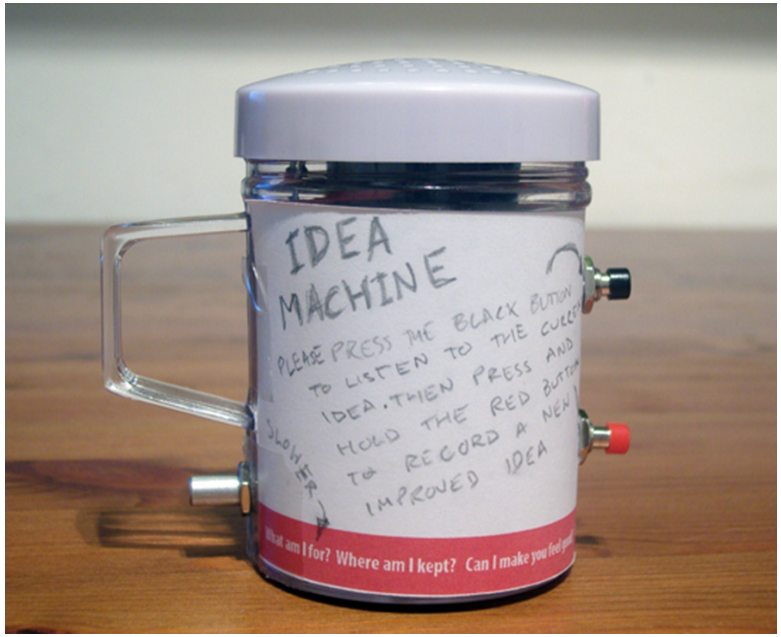


Image 2 (left):

A photo that one participant took while using the device for orienteering with her girl guides.

Image 3 (right): The same device was also used to stop a dog from barking.

An experimental process was developed from existing literature on both ambiguous deployment and user tool-kits (discussed on page 12).

To begin this process, members of the public were given a device with no specific purpose, as a method of encouraging them to consider how it might be used and developed into a product that is relevant to them. A response was encouraged by various means, including the placement of a blank label on the product (Image 1), or giving them a camera to document their time with the device (Image 2 & 3).

After a week the participant was met to discuss how they used the device. Having to decipher its purpose encouraged them to respond creatively and not only discuss their ideas but also their interests and desires.

The designer then interpreted there response in order to build a working prototype that enabled them to test and therefore improve their designs, or suggest completely new ideas. Where possible, iterating the devices as quickly as possible was used as a method of allowing the participant to feel involved in the design process.

The result of this process is a vast array of design concepts that can be selected by market testing and then developed into a fully-fledged product.

Method Example

First Device:

On your right is the first device used to test this method of working. It consisted of sound recorder that was integrated into a parmesan shaker. One participant used it at the front door as a reminder of things she and her family had to remember before leaving the house. This included shutting the windows, taking a letter to be posted or remembering your packed lunch.

Second Device:

A new design was then made for this participant. This was a device for remembering before leaving the house, it was re-designed to hang on the front door handle and activate when you open the door to leave.

Third Device:

As the device is still open to other uses, another participant adopted it in a variety of other ways. In particular she was keen to have a bright and colourful product that was designed to make treasure hunting for girl guides more engaging. Again this product was made and tested.

People

This project relied on the input of ordinary people from all over Edinburgh. These individuals were found through ads on Gumtree.com and Google Adwords. In order to find individuals with an interest in design and new technology, Google Adwords was used to target people searching the internet for specific terms, such as gadgets or new technology.

People ranged in age from 21 to 64 and had various interests and professional backgrounds from Raja Yoga practitioner to shop keeper (Image 1). The designer found this exciting as participants would all interpret the objects differently based on their demographic.

Image 1:

A diverse range of people took part in the project and contributed to the concepts developed throughout this book.

.net Gadgeteer

Image 1:

Existing technology was hacked in order to make some of the prototypes.

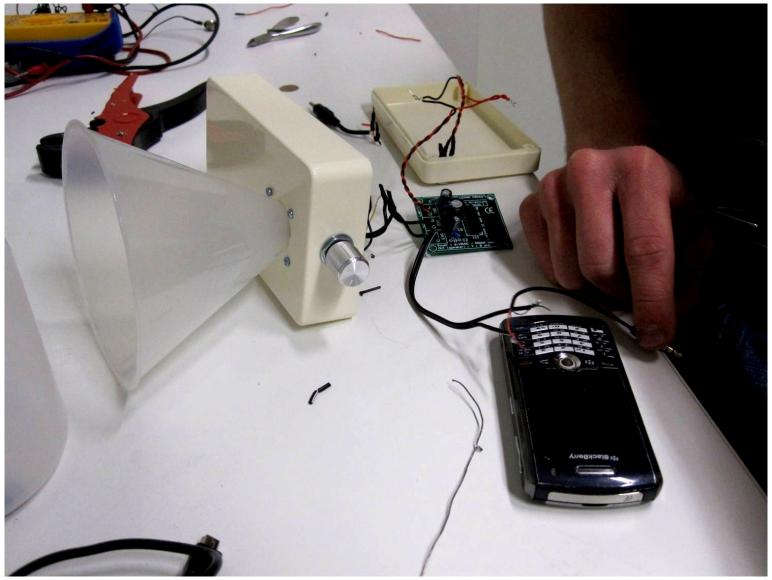
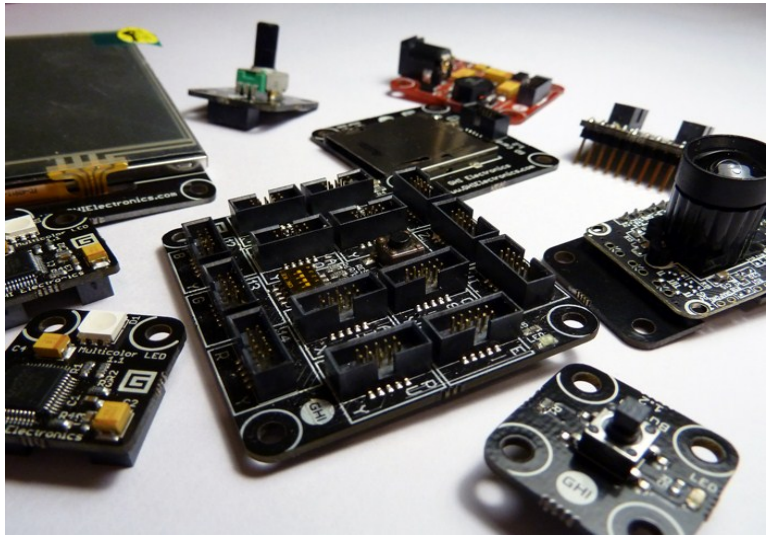


Image 2:

Microsoft donated a .net gadgeteer kit that was used to build most of the prototypes .



This method of working required participants to test and therefore fully experience their concepts, through working prototypes. In order to build these devices as quickly as possible, the designer began using electronic kits and hacking existing components (Image 1). However, while discussing the project with a researcher from Microsoft, it was suggested that the speed and quality of prototypes that can be built with the Microsoft .net gadgeteer (Image 2) would make it ideal for working in this way. Given their interest in finding new applications for this technology they donated a kit.

The .net gadgeteer is a modular hardware device that has a variety of modules to support sensing, display and user interaction. Its really easy to use (assuming you know a little coding) and is very robust when deployed. The author argued that modular prototyping technologies support the rapid-iteration of devices as a viable and cost effective method of giving users more input in the design process.

Literature

This page gives a brief overview of the key ideas that informed this method of working. For a full report that justifies this process please visit **www.tommydykes.com/iterative deployment**.

The designer was looking to develop a method of encouraging people to become active partners in the design of novel products (Sanders & Stappers, 2008), before a need or opportunity has been found. When developing new devices at the beginning of the design process, there are no existing products to encourage comment or discussion and so it may be hard for the user to imagine, and therefore communicate product ideas (Hoonhout, 2007). This led the author to use a method of encouraging people to provide their opinions or ideas for product development, through devices that have no obvious purpose.

Often within HCI or product design, working prototypes are tested 'in the wild''. Basically, given to participants for a period of time in order to test a system or answer a research question. This is called deployment.

The work of Michael and Gaver (2009) suggests that the use of devices with a clear function but no specified purpose can encourage people to respond to a deployment prototype by suggesting, "how it could work, how it could be developed, what it shows, and what it means for the home" (p.8).

Other projects also use ambiguous prototypes (Dunne & Rabby, 2001; Gaver, 2004) as part of an isolated research exercise alone, and yet this method shows potential for generating insights that could inform the design of products. The author therefore used the discussions that follow from a participant's use of an ambiguous prototype as a tool for generating product ideas, which can then be made and tested and further developed by the same participant.

User Engagement

Prototypes

This section discusses a few of the prototypes made during this process. Each prototype was created for participants in response to there use of an open-ended device.

Messenger

If you email or text this device, which has dedicated contact details, it will read the message out loud in a computerised voice, like an announcement.

This was used as a means of communicating how you feel within a public space without having to identify yourself. For example, if someone is talking loudly within an office or studio you could ask them to be quiet without the discomfort of having to speak up for yourself.

Door Reminder

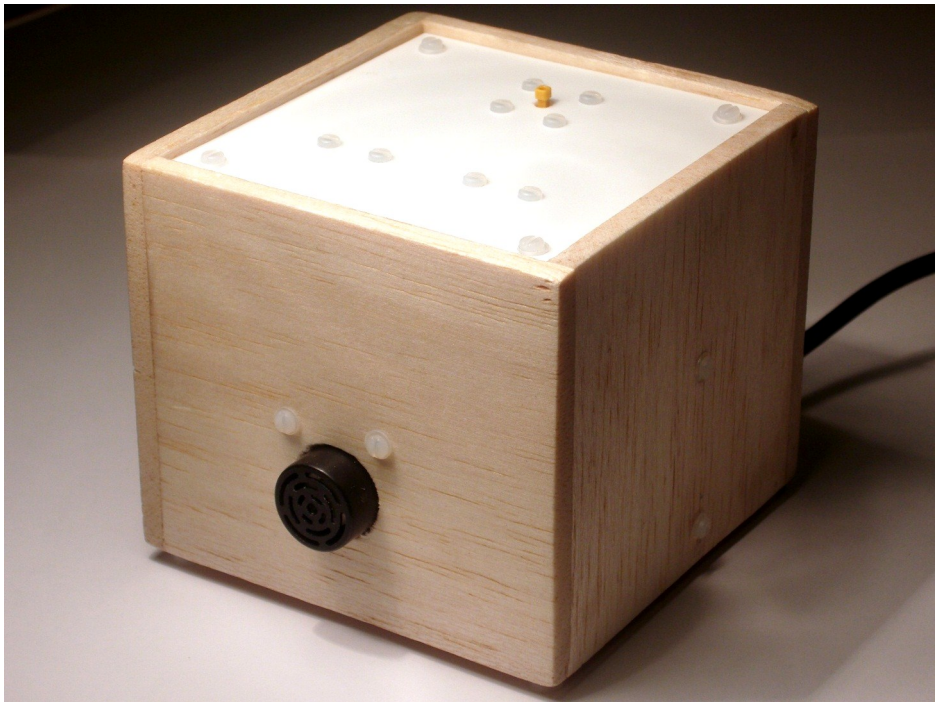
This device is an audio recorder that will playback a message when you open a door, and therefore interrupt you as you're rushing out the house. Its intended to remind people of tasks they must do, or things they must take with them before leaving the house. This might include shutting the windows, taking a letter to be posted or remembering a packed lunch.

This concept emerged because one participant was talking about leaving objects at the front door to remember them. With this device she was also able to remember tasks before leaving the house.

Treasure Hunt

These devices are for Girl Guides. They allow you to hide riddles or coordinates for further locations within the park or countryside. The participants aim was to provide a fresh and playful means of engaging a younger audience in outdoor activities, such as orienteering. The devices were designed to easily hang high in a tree so that to hear the recording you must climb up or find a long stick. They were also given different levels that ranged from easy (yellow) to hard (black), according to how difficult they were to find.

Noise Box



The noise box brings new influences and information into a user's life with little effort. It does this by connecting to the internet and grabbing something at random, such as, music, facts or book clips. In order to catch your attention this audio is played when you walk past the device.

photoBot

Development

photoBot was the concept chosen for further development to an exhibition standard. This section discusses key stages in the products development.

First Prototype

***photoBot* emerged through the iterative deployment process and was chosen for further development to an exhibition standard.**

The first deployment that led to *photoBot* is shown in Image 1 and Image 2. This was a simple camera device that was intended to encourage participants to explore how the device might be used.

If you press the button on the back a small viewfinder is revealed that allows you to set up a shot (Image 1). If the device hears a sound of a given volume, such as a clap, as set by the dial on the top, it will take a picture.

The device is made of a cardboard tube that has paper wrapped around it. This material was chosen to make the device seem less delectate or precious, and therefore defaceable.

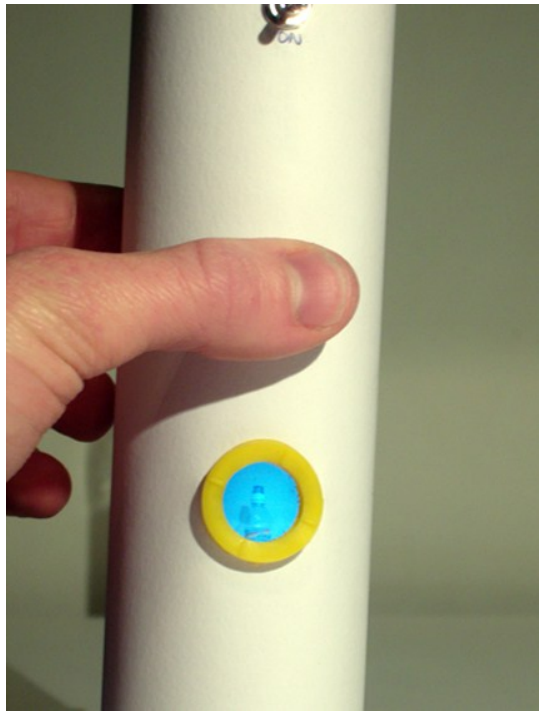


Image 1:

The first prototype showing the viewfinder that is revealed when pressing and holding the button.

Image 2:

The first prototype showing the overall profile.

Party Cam

A participant used the prototype shown in Image 1 to capture photos at a party. It had been placed at the side of her living room and occasionally moved in order to automatically capture events as they unfolded throughout the evening.

On looking at the photos we also find that people had put their faces into shot, something that could be encouraged in future prototypes.

Of interest was her excitement at waking up to remember the device had been active and therefore captured photos of the evening.

This participant liked the idea and her alternatively composed photos. Therefore, it was developed further by considering her suggestions and insights that had emerged during our discussion.

Image 1:

A selection of party photos that one participant had taken with the first prototype.

photoBot

***photoBot* was explored through a series of sketches and built using cardboard tube (Image 1). As some people thought the first prototype might be for spying, the aim was to create a friendlier form.**

The .net gadgeteer was integrated into the device along with a camera module, LED's, SD Card and a servo (Image 2). To capture different photos the first device was turned by the participant. Instead, this prototype would turn and take photos of its own accord. To access the photos an SD card can be found on the back of the device.

Version 1 of *photoBot* was deployed in order to find any unseen problems and to get a sense of peoples response to its appearance. Here the roundness of the device was popular and people confirmed it had a friendly appearance. Other significant factors included the need for feedback when a picture was taken and the possibility of sensing its environment, rather than taking photos of empty spaces.

It looks really cheerful, its almost like a face with two eyes... There is something about its roundness..." —Lilly Worth.

Image 1:

This prototypes head moves around to take photographs.

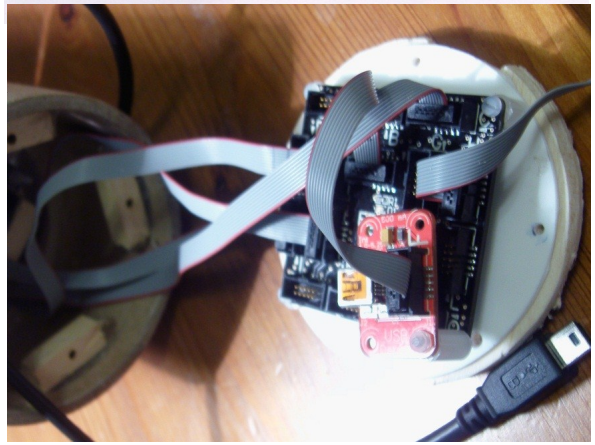


Image 2:

The .net gadgeteer was integrated into the device.

photoBot 2

***photoBot* 2 is a modified version of *photoBot* 1. He was used to explore and prototype how best to use an ultrasonic ranger to determine where there are people, in order to take photographs of them.**

An ultrasonic ranger uses high frequency sound to determine the distance to the nearest sold surface, its often used in robots and automatic doors. By comparing two sets of values you can determine where there is movement.

In order to continue the theme of using facial features as a means of creating a friendly appearance, the ultrasonic ranger was placed centrally, below the camera and LED.

The eye now turned red when it takes a picture in order to provide feedback as to when the device took a picture.

A screen and dial were also added for prototyping and exploring what features should be included. By turning the dial you could change the number of photos per minute and by pressing you can alter the sequencing of photos.

Image 1:

Amongst other additions, *photoBot* 2 was given a sensor that is able to detect movement.

Aesthetic Influences

photoBot was given a friendly appearance by using anthropomorphic features, such as a head and body and by composing the components to form a face. The aim was to encourage an emotional response that makes people like the product, as well as creating a strong brand. This approach is supported by many studies and existing examples. While discussing the VW Beetle (Image 1), Miesler (2011) states that:

"Through using such appearances, product designers make use of a deeply embedded human trait already known to psychologists and anthropologists where, due to the evolutionary significance of human features, perceivers are highly sensitive to them and attracted to them."

Other influences include the work of Allessi which makes characters out of its product as a means of building a strong brand that people pay a premium for (Image 2).

The aim was to subtly include anthropomorphic features whilst creating a device that people would happily have around the home. The designer always appreciated and aspired to the simple styling of Muji products, which was an influence when developing this product (Image 3 & 4).

Image 1:

Anthropological features used to create an emotional response.

Image 2:

Allessi products often use characters as a means of creating a unique product.

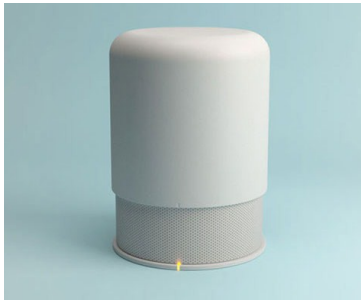
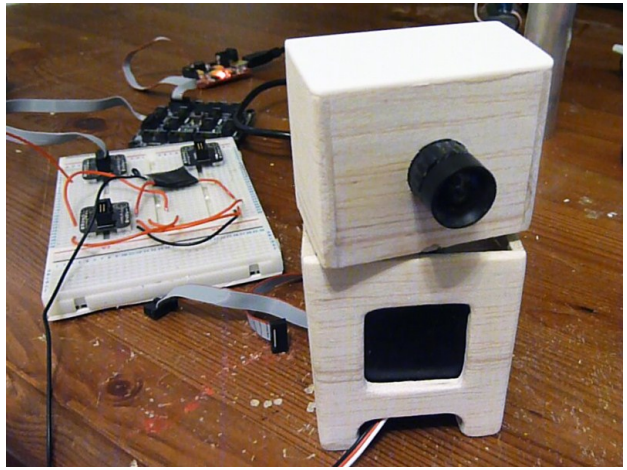


Image 3 & 4:

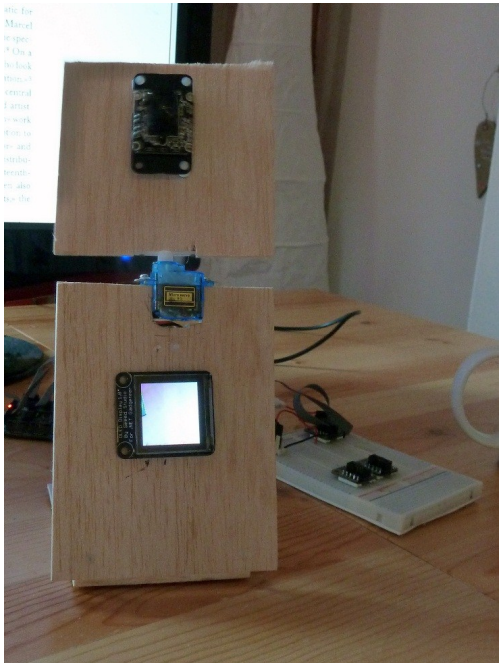
The designer has always aspired to the simplicity of Muji products which have been an influence throughout this project.

Other Prototypes



This was built to consider a smaller form.

It was also used to explore how the head's movements might be made more human by adjusting the servo motor's movement.



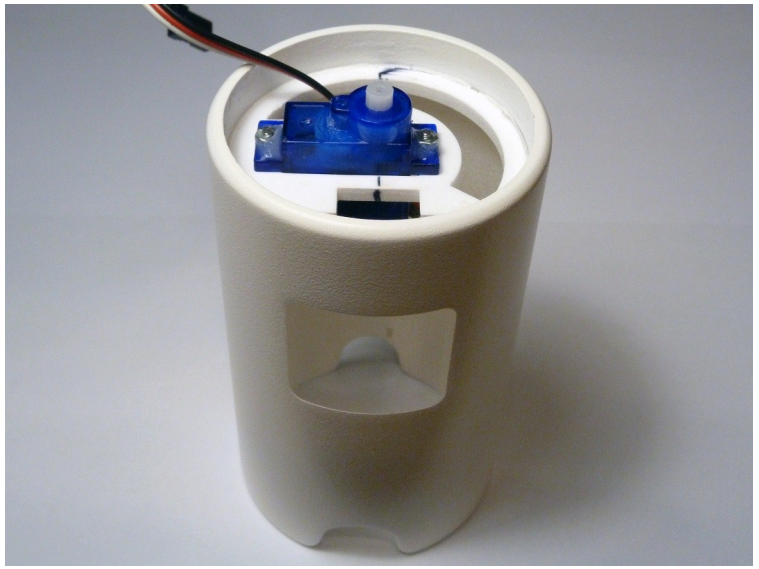
A prototype that was built to develop the code and hardware components for the final exhibition prototype.

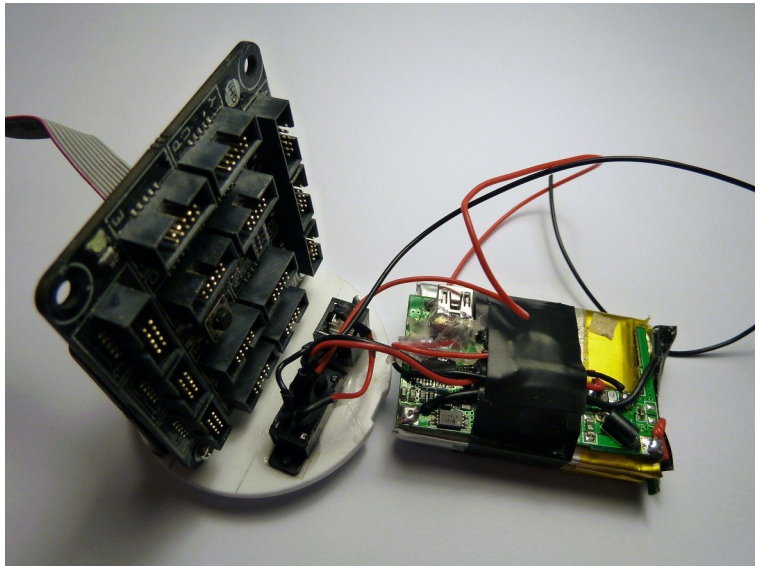
This prototype was made for user testing and to detail and refine the making process. It consisted of balsa wood and Perspex.

Making the Exhibition Prototype

The prototype is made of tubular Perspex that's been hand shaped and sprayed to create a plastic like finish.

All non-cylindrical parts were laser cut in order to accurately locate the components on them.





The .net gadgeteer was vertically mounted to the base along with a USB battery, SD card and power board.

In order to fit everything into this small form factor a custom circuit board was built within the head.

Exhibition

Discusses the most significant aspects of the exhibition design, including a communication strategy, sketches, prototypes and the final 3D CAD model.

Communication Strategy

This page discusses the key aims that informed the exhibition design. Firstly, given that *PhotoBot* is to be exhibited amongst other larger objects, such as furniture, there's a need to draw attention, from a distance, to both the exhibit and the product.

The designer will present the product as a party accessory that is fun and playful, whilst still effectively demonstrating its purpose. It's also important to present your skills as a designer and so the space will be professional and well-finished.

Its important that the viewer is able to interact and see the object in use. This will help explain the object's function but also make the visitors experience more memorable.

Finally, since the exhibition is about the product, care should be taken not to detract the viewer's attention elsewhere. The aim is to complement the object by creating a display arrangement that is in keeping with its clean and simple design, whilst also demonstrating its context.

Research

In order to gain inspiration and understand the constraints of exhibition design, various museums and galleries were visited and researched through secondary sources. This page shows the most significant influences.

Central to the communication strategy was a need for the object to be noticeable from a distance. This could be achieved by creating a larger display out of multiples of the device. For example, The 'Tengu Orchestra' (Image 1) by Crispin Jones involved the exhibition of a small gadget called Tengu. By having many Tengu's on a tiered plinth, all working concurrently, Jones was able to present the device in a larger and more entertaining manner. This was confirmed by Bitgood *et al.* (2001), who found that large plinths tend to affect traffic flow by encouraging visitors to move towards them first.

Image 2 is an exhibit at the Kelvin Grove Art Gallery in Glasgow. It shows how the design of a stand can make a small object appear more prominent. Here the use of a thin stand with light shone from below creates shadows that highlight the features of the face. This display informed the idea of perching *photoBot* up high in a more prominent location, as if he is looking out at the viewer.

Three Arrangements, by George Brecht at the centre de Pompidou in Paris (Image 3) caused the author to consider presenting the context of the final device by replicating a shelf in the home. Attention could then be drawn to the product itself, by using carefully positioned spotlights.

Image 1: Tengu Orchestra.

Image 2: Museum Exhibit.

Image 3: George Brecht, Three Arrangements.

Sketches & Prototyping

Various sketches and illustrations were used to explore how the object was to be exhibited. Building on the examples shown previously, the designer began exploring the use of tiered plinths (Image 1). To make the exhibition more engaging, the author also considered projecting photos from the *photoBot* onto plinth tops, as they were taken (Image 1).

Other ideas included the use of shelves and objects you might find on them, such as books or party paraphernalia (Image 2). This would act as a means of suggesting a context of use to the viewer and provide a location for the project book and an IPad, which would stream photographs as they were taken. Given the small size of *PhotoBot* and a need to draw the viewer's attention, it was decided that exhibiting on a shelf with other objects might detract from the device itself. As such the designer focused on the use of tall plinths with varying heights.

The height, shape and layout of the plinths were explored by creating rough experience prototypes (Image 3). This exercise confirmed the visual appeal of the tall plinths and allowed the designer gain feedback from others about the exhibition design.

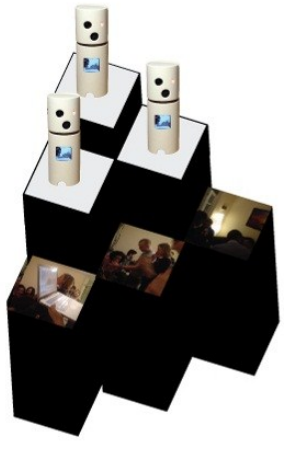


Image 1: Tiered plinth.

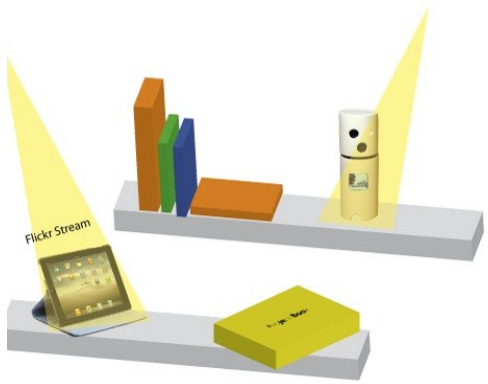


Image 2: Sense of context through shelves and related objects.

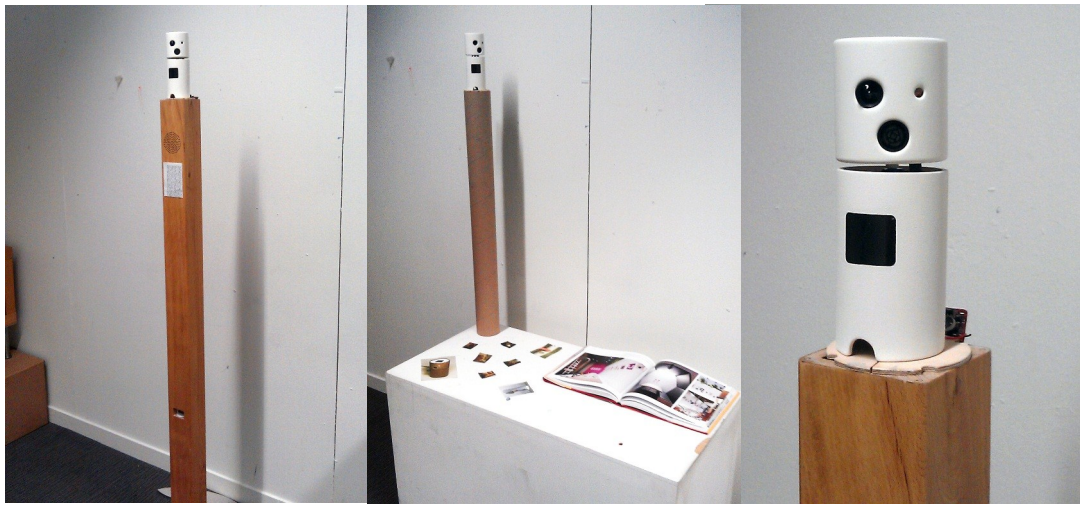


Image 3: Experience prototyping of the exhibition design.

Plinth Designs

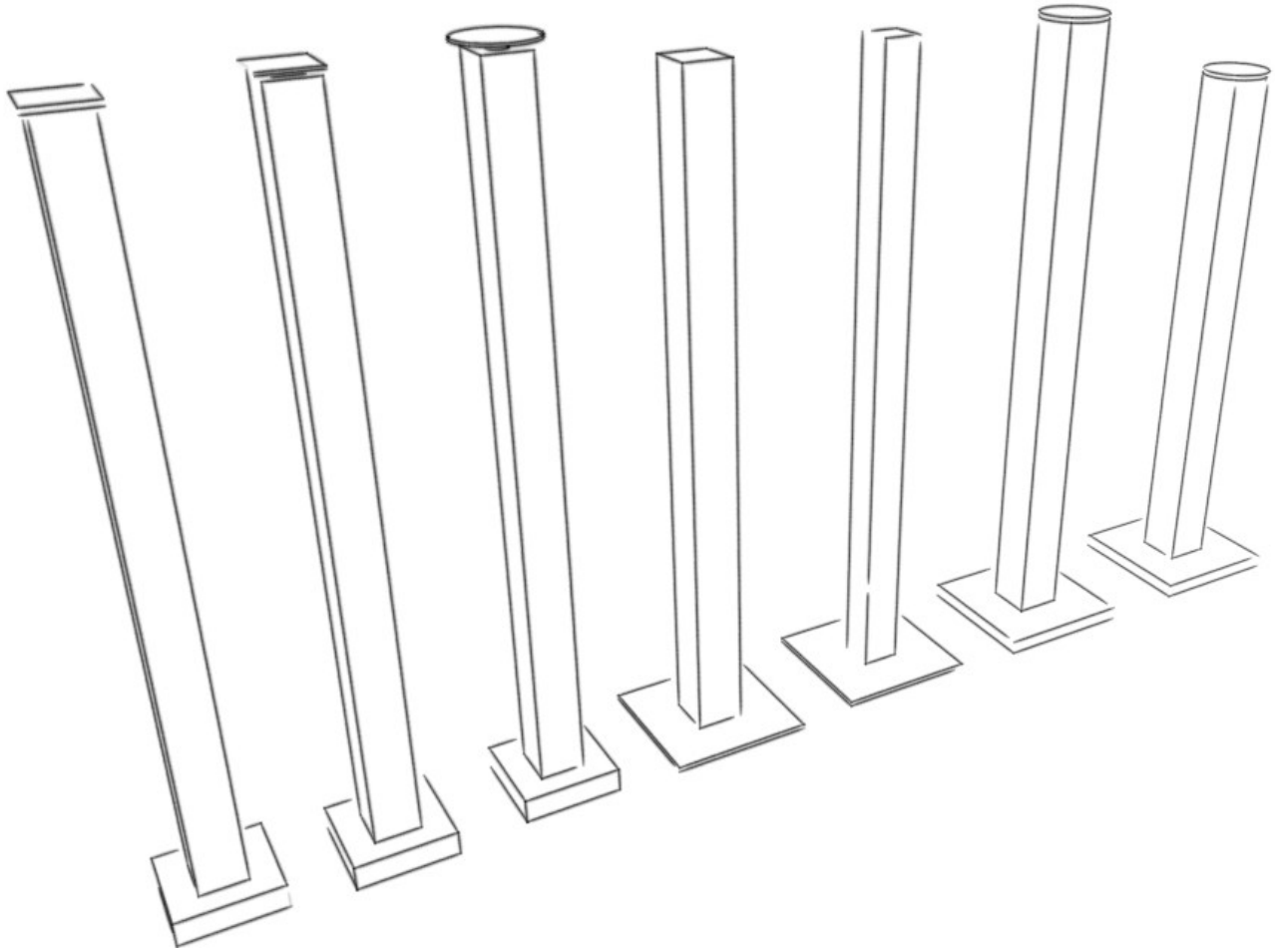


Image 1: A series of sketches detailing the final plinth design.

Final Design

The plinths have been made tall and thin and located away from the wall to ensure the product gets noticed from a distance, and from more locations around the exhibition space. It's also been shown that people are drawn towards objects and interactive exhibits first, before images, text or diagrams (Bitgood *et al.* (2001). The designer therefore wanted *photoBot* to be the principal thing that people see.

Space has been left in front of the devices so that people have space to interact and have their photo taken, but also so they can move around and close to the objects, being able to inspect them without touching. The thin plinth design compliments the object by not dwarfing it on a larger plinth and its simple, clean style does not detract from the product itself.

The space was divided into four areas. As mentioned, the viewer is drawn towards the objects and after observing them can read the blurb if they wish. Following this a selection of context images has been included to help describe the purpose and context of the object.

These photographs are carefully composed to explain *photoBots* use and provide a sense of context. By using colourful balloons, cards and streamers the images create a sense of fun and add a splash of colour to the otherwise white space (Image 1). They suggest movement, and by placing different images on the screen explain the candid type of snaps that *photoBot* will take.

Image 1: An example of the exhibition photos

Finally, there is a larger plinth with an Imac computer, project book and business cards. Here the viewer is able to look at the photos taken by the product and if they wish find out more through the project book.

As a further reminder of there time in the space the viewer is able to request photos by selecting them, and then providing an email address.


PhotoBot

Appraisal

This section critically reflects on the project and the final concept.

The project began by exploring a method of working rather than focusing on a specific topic. By reviewing design literature the author proposed and used a design process that led to a selection of product ideas (as described on page 12). While future work will use *similar* methods of encouraging people to contribute to the design process, he will not work in this specific manner again.

The volume of prototypes made, combined with learning to use the .net gadgeteer, made the work very time consuming. On occasions the author struggled to combine an interest in reflecting on the user engagements, designing and building products, coding and meeting the course requirements. This affected the quality of individual concepts. If this process required the building of less prototypes then more time could have been spent developing individual devices.

It may have been more productive to have selected and worked with a single user-suggested product earlier. This would have given the designer a single focus to work with and therefore the chosen product could have been more resolved. Picking an area of interest around which to use this iterative deployment process would have also allowed a deeper focus on a single product. Participants could then have self-selected for participation based on a strong interest or need that is represented by that specific topic. For example, the design of a novel camera device through this iterative deployment approach. Participants would then have had a genuine interest in the topic and have been more motivated to contribute.

At times it was hard to know how people were actually responding to prototypes that were made for them. People don't always tell the truth in the presence of a researcher or designer. Meeting in a participant's home rather than a coffee shop would have allowed more intimate access into their lives, providing a more realistic understanding of a prototypes use.

Finding ways of giving the participant more hands on access to the development of a prototype, rather than the designer alone making them, would have given the user a greater level of participation and therefore the concepts would have been more valued by them. Though some methods were explored these were never fully resolved.

If the process was followed again it should involve the inclusion of a wider range of users, and some form of market testing when selecting products. This will provide a stronger justification for their development and make it easier to convince manufactures of a products likely success.

The designer was away from the project for 6 months, and it was cut short by a semester, which affected the projects resolve. To complete this module on time a concept was selected and made to an exhibition standard. Had there been more time the designer would have worked on other prototypes and developed and tested them to a higher standard.

During the project the author was able to meet Tim Regan from Microsoft Research who donated a .net gadgeteer kit. Tim also invited the author to an internship at their offices in Cambridge and following the internship are funding a PhD at Northumbria University. Rhode Island School of Design (RSID), where a previous tutor now teaches have also begun exploring their own version of this iterative process called "Disruptive Design" (http://interactiondisruption.wordpress.com/).

The author will embark on a practice-led research career through a PhD at Northumbria University. His ultimate goal is to work within a research laboratory such as HP-Labs in Bristol or Microsoft Research in Cambridge. This work is a continuation of various themes throughout the designer's portfolio including novel ways of reminiscing and designing for the elderly. It's also an extension of a project that was started during an internship project at Microsoft Research. This work will look at ways of creating a sense of home when elderly individuals with dementia have to move into a care home. It will involve designing objects for the individual, which will require the development of creative methods of engagement with them in order to involve them and therefore fully understand their needs.

Final Design

The complexity of *photoBot* made it a challenge to build and so various compromises were made along the way. The aim was to balance all the constraints involved in making the device in order to demonstrate the concept as effectively as possible.

The idea was to develop a device that was less random and would be able to compose photo's by analysing an image and working out the location of people. This proved very difficult to achieve and so the concept has been simplified. Trying to process images with the .net gadgeteer, which has a much higher spec than most microcontrollers, took up to 3 minutes.

Initially the designer had wanted the device to facilitate group photos, yet never had time. This was to be achieved by either clapping or waving in front of *photoBot,* which would cause him to move into a central position and stream an image so people can compose a photo. Not having this functionality was unfortunate because it would have made the device more interactive and engaging to the user.

Testing

The device was tested as family and friends celebrated a 30th birthday party. While peoples honesty is likely to be effected by their relationship with the designer, it offered the ideal scenario for testing. *photoBot* was set up at a central location that would allow it to take photos and where it was expected people would notice the device and ask about or discuss it (Image 1).

Image 1: Testing *photoBot* at a 30th Birthday Party.

The most successful aspect of testing was peoples response to the aesthetic and the way the device moves and looks around. One individual told the designer that it was “cute”. On a separate occasion when the device was being photographed the photographer also expressed similar opinions.

The designer found the device to be too placid and un-engaging. People never posed into the camera as they had with a previous prototype. While *photoBot* took un-posed candid shots effectively, an element of interaction is required to ensure that people pose and play in front of the device. This could be achieved with the group photo function discussed previously. Or by having the device sense people around its full circumference, so that the face could instantly move to look at people, rather as checking other positions first.

Peoples interaction with the device may have been impaired because they are uncomfortable having there photo taken, and don’t like candid and realistic pictures of themselves. Further research would be required, however this could be a major problem with this concept.

The .net gadgeteer camera is poor quality and does not deal with low light levels effectively. This meant that it was difficult to discuss and gauge the success of the final photos (Image 1).

Conclusion

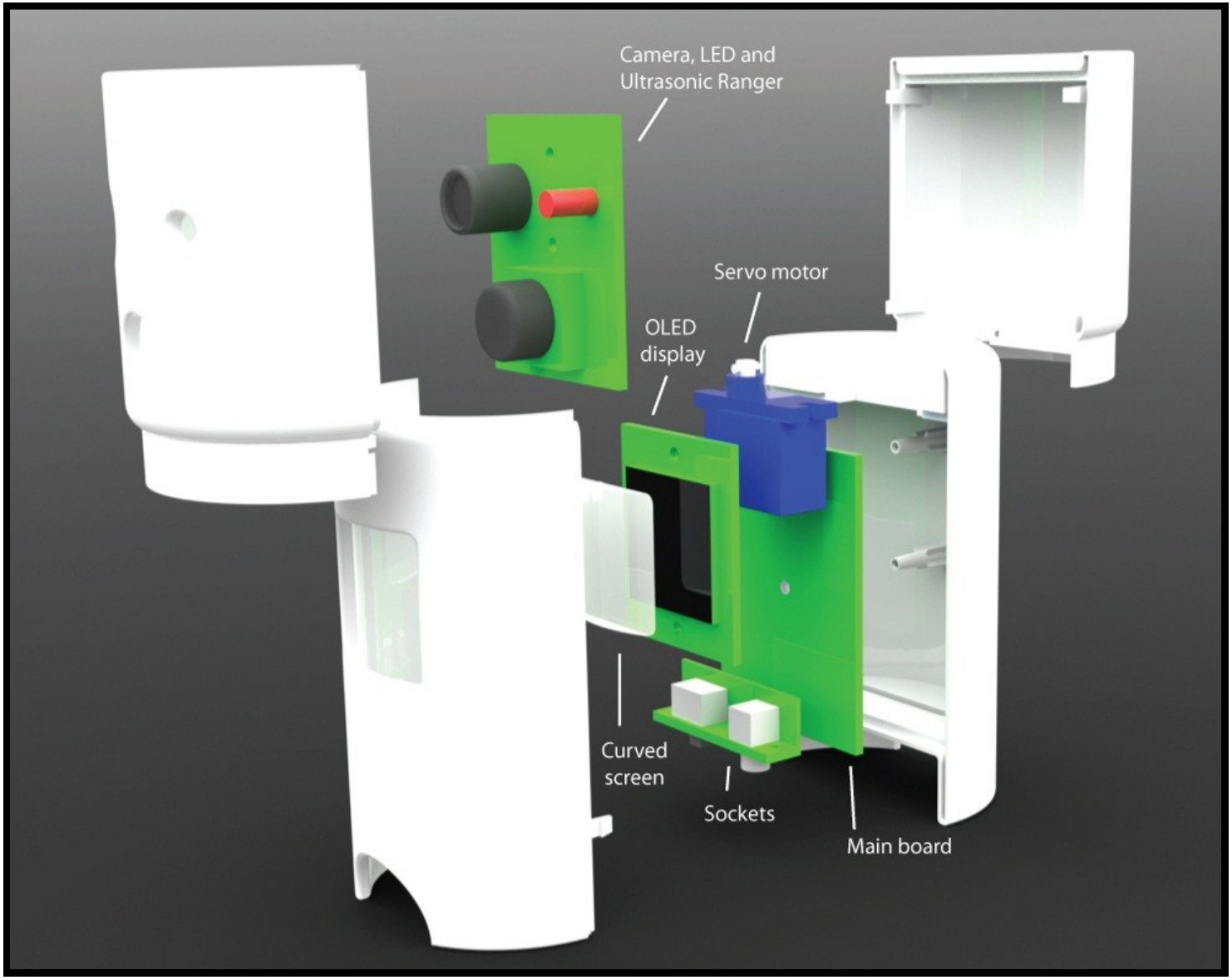
While *photoBot* contains many of the elements required to effectively demonstrate the concept, it does not fully represent the designers vision. The aesthetic, look and feel of the device work, however it’s necessary for the device to be more interactive and responsive to peoples presence. Given further development *photoBot* could become a central part of any party or occasion, were various features would encourage people to pose and interact rather than just taking candid shots.

Image 1: Some shot’s from testing photoBot.

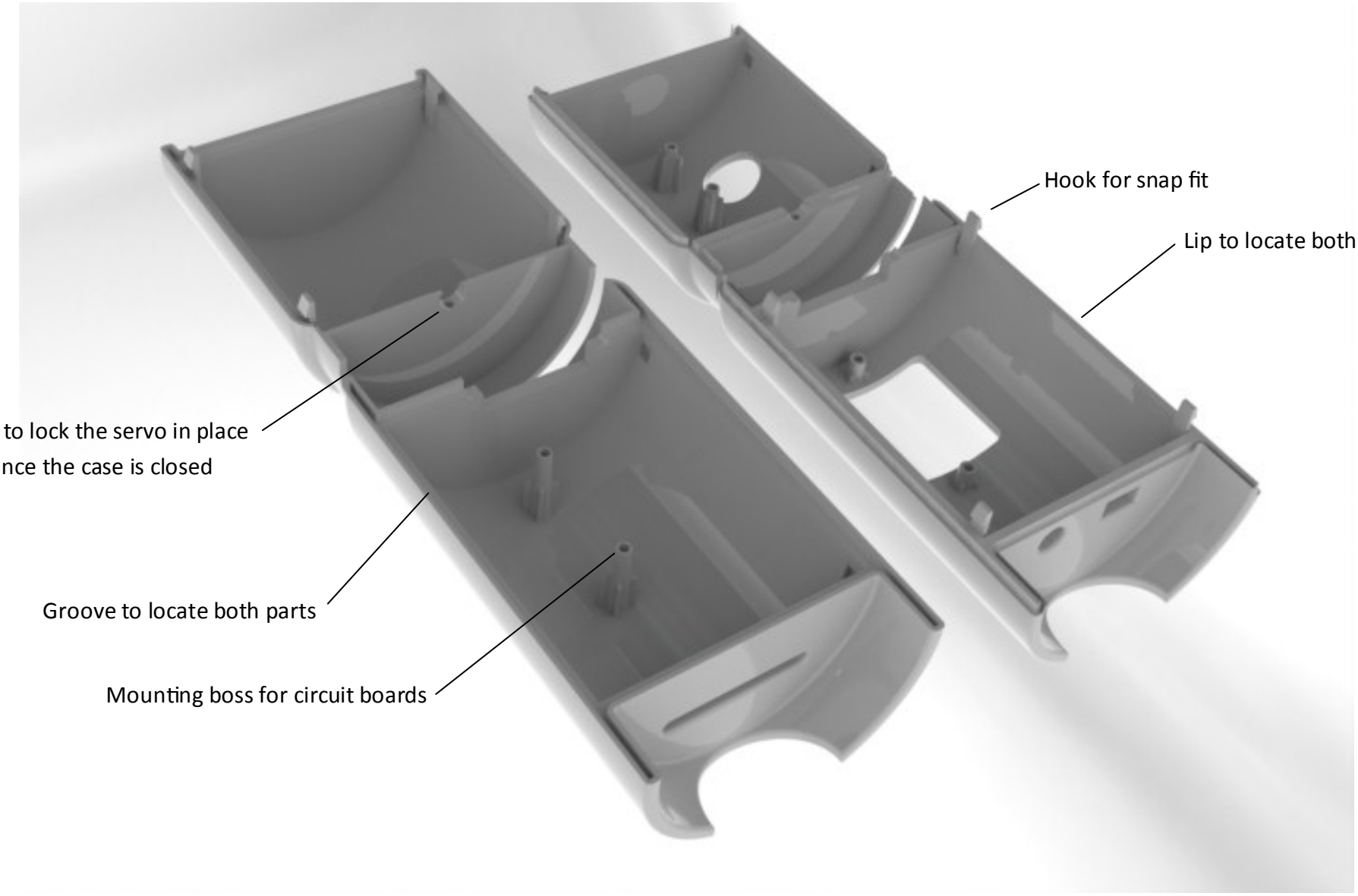
Technical

This section includes material selection and justification, manufacture, costing's and detail drawings.

Assembly

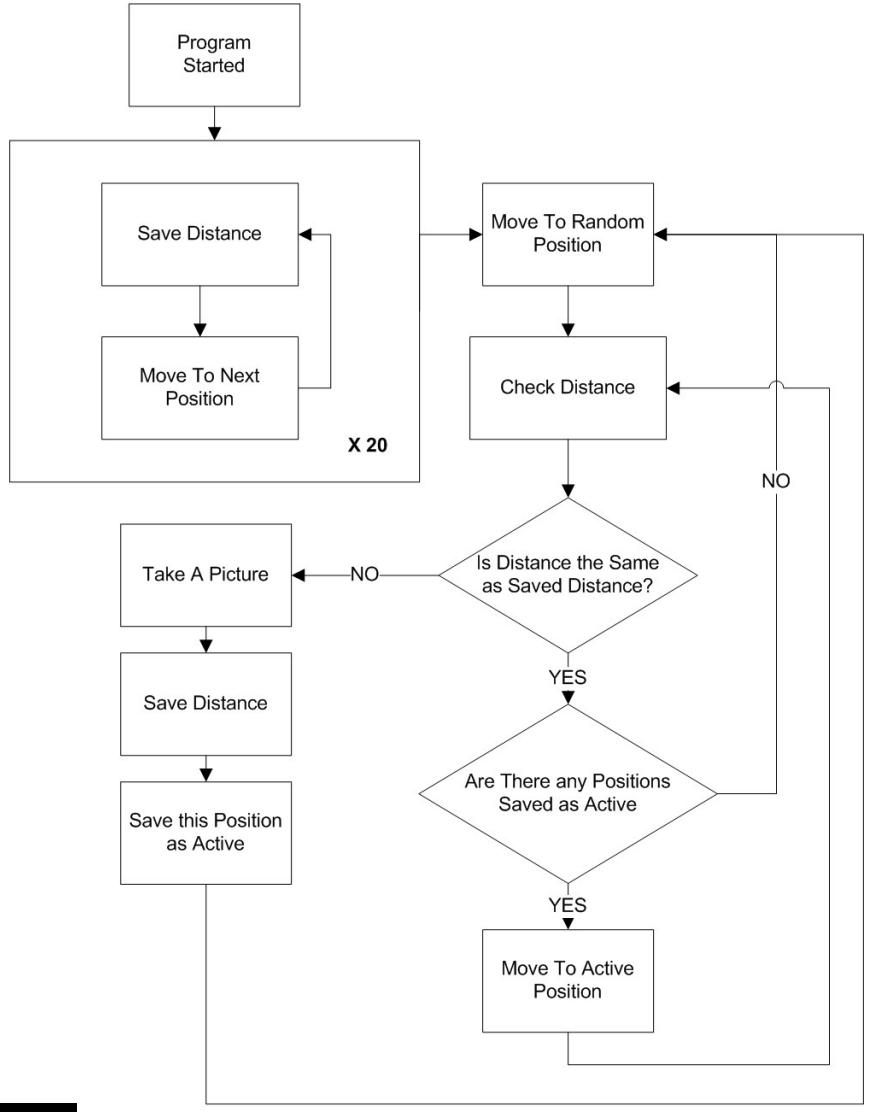

Camera, LED and
Ultrasonic Ranger
Servo motor
OLED
display
Curved
screen
Sockets
Main board

Body Design

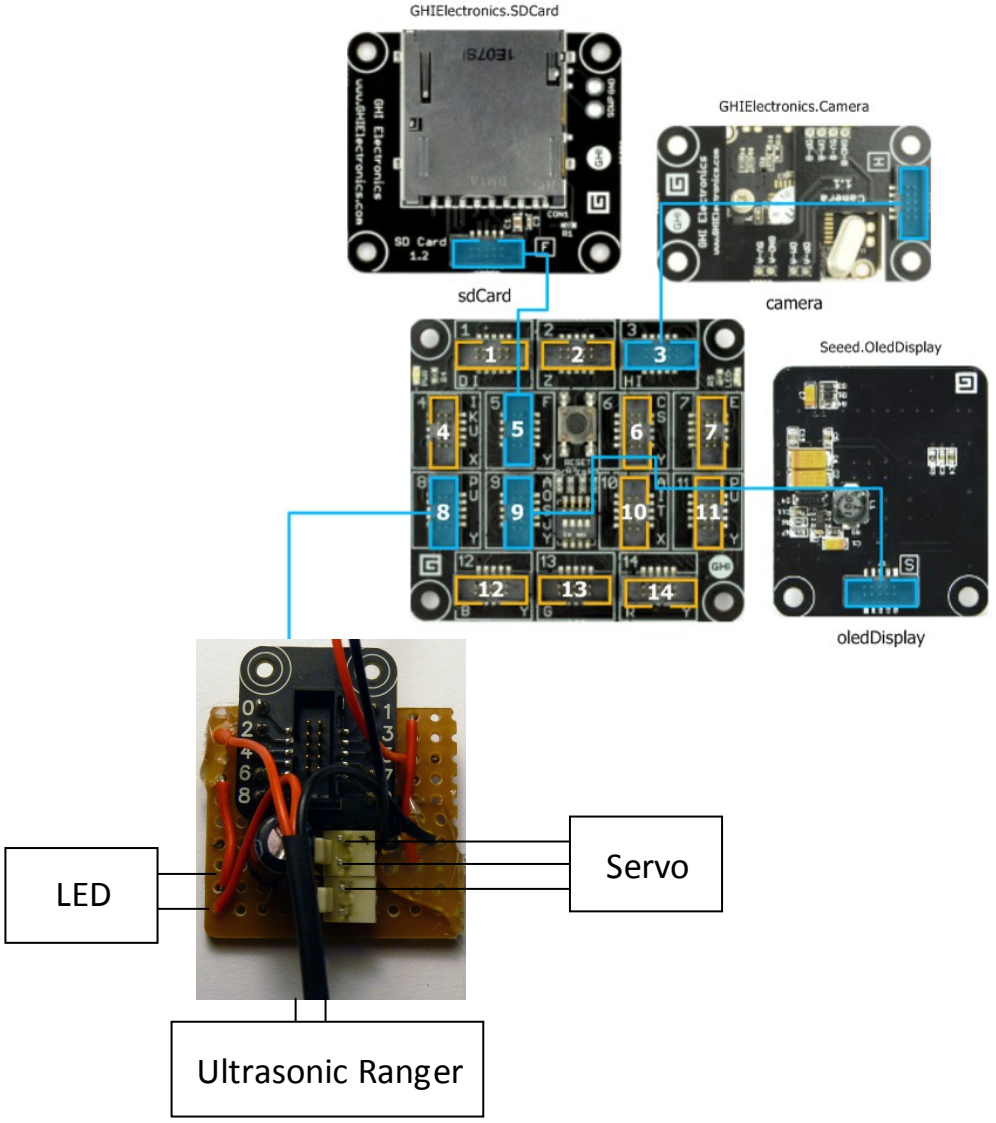

Hook for snap fit
Lip to locate both parts
Hole to lock the servo in place
once the case is closed
Groove to locate both parts
Mounting boss for circuit boards

Exhibition Prototype

Functional Flow Chart:



Circuit:



Estimated Part Cost

Manufacture:

The product will be manufactured by Injection Moulding, which offers good surface finish for small components. While capital costs tend to be medium to high, the product is intended for mass production at a high volume.

Material:

The body material selected for the product casing is a white ABS plastic. The product requires a low cost, resilient plastic that is easily moulded and takes colour well.

The curved screen will use a clear ABS plastic, which has excellent transparency and a high impact strength.

Estimated Cost of Injection Moulded Components:

Calculation is an estimate from protomould.co.uk.

Back of Head

Tooling Cost: £1,975

100,000 units: £1.18

Front of Head

Tooling Cost: £2,005

100,000 units: £1.07

Back of Body

Tooling Cost : £3,770

100,000 units: £1.17

Front of Body

Tooling Cost: £4,611

100,000 units: £1.13

Total Capital Cost: **£12,361**

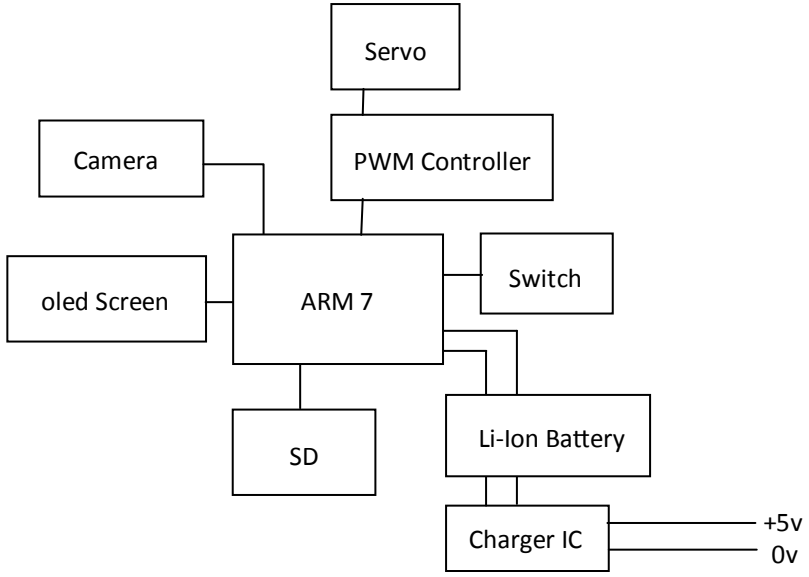
Cost of All Parts: **£4.55**

Estimated Component Cost

Overview:

This device is basically a repackaged digital camera with only two added components (a servo and PWM controller). It's therefore realistic that with further work it could retail at an RPP of £40. Vivitar currently sell a 7MP Camera for £24.99 (Currys.com).

The total cost of £66.98 is much too high to achieve a £40 RRP. Costs could be reduced by increasing production, sourcing cheaper components and re-designing the parts to use less materials.



Estimated Cost of Components:

Supplier: http://uk.farnell.com

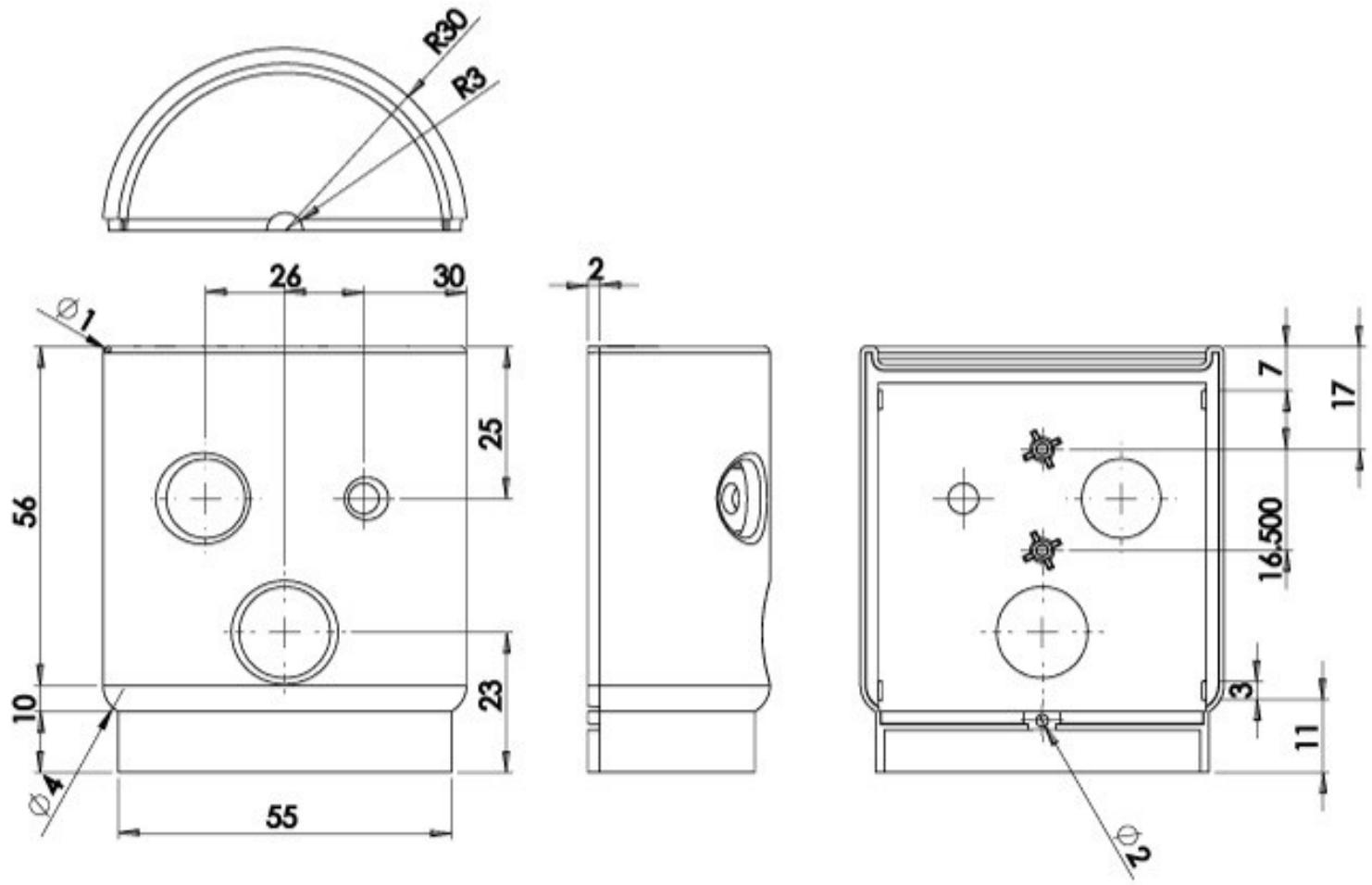
Part No.	Part	Unit Cost
1829707	**PMOLED, 128*128, COLOUR**	11.81
2081360	**MEMORY SOCKET, SD CARD, 9WAY**	1.95
1777668	**SENSOR, ULTRASONIC, 0.2-4M, RX**	3.78
1889307	**DC SOCKET, SMD, DC-8S, 1.3MM PIN**	0.45
1123876	**SLIDE SWITCH, SP 3 POS, VERT**	0.60
1162633	**IC, MCU 16/32BIT ARM7TDMI CORE, SMD**	6.57
1142548	**LED, FLAT TOP, 5MM, RED**	0.05
2077886	**BATTERY, LITHIUM POL, 3.7V, 1300 MAH**	9.96
1801172	**LINEAR TECHNOLOGY - LTC4070EMS8E#PBF. - IC, BATTERY CHARGER, 50mA, MSOP-8**	2.67
2094229	**ANALOG DEVICES - ADP1872ARMZ-0.3-R7 - PWM, BUCK, 300KHZ, 0.6VMIN, 10MSOP**	1.02
1182578	**SXGA 1.3MP Colour Camera, Flex Cable**	24.02

Total Cost / Unit **62.43**

Cost of All Parts: **£4.55**

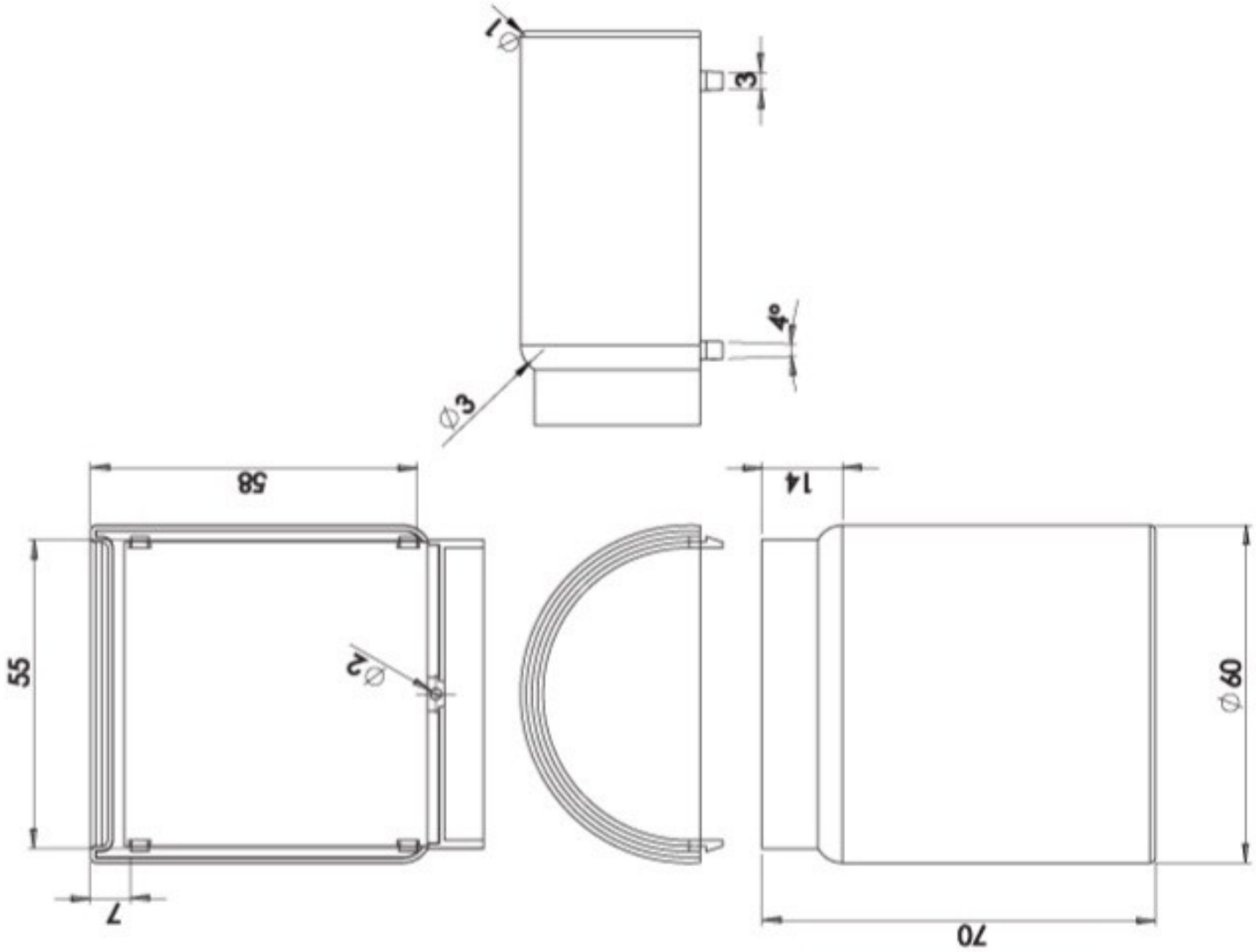
Total Cost of *photoBot*: £66.98

Component Detail Drawings

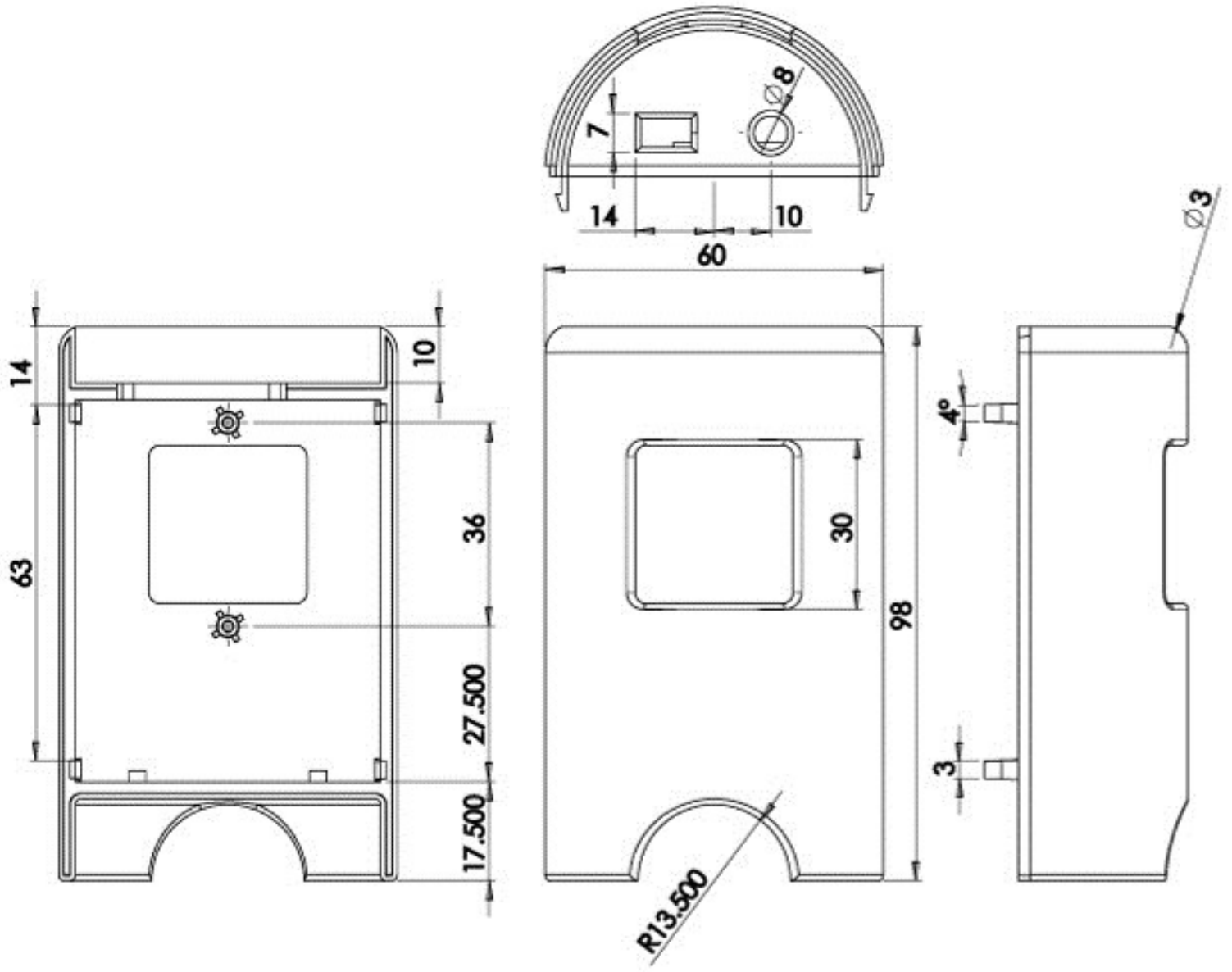


Front of Head

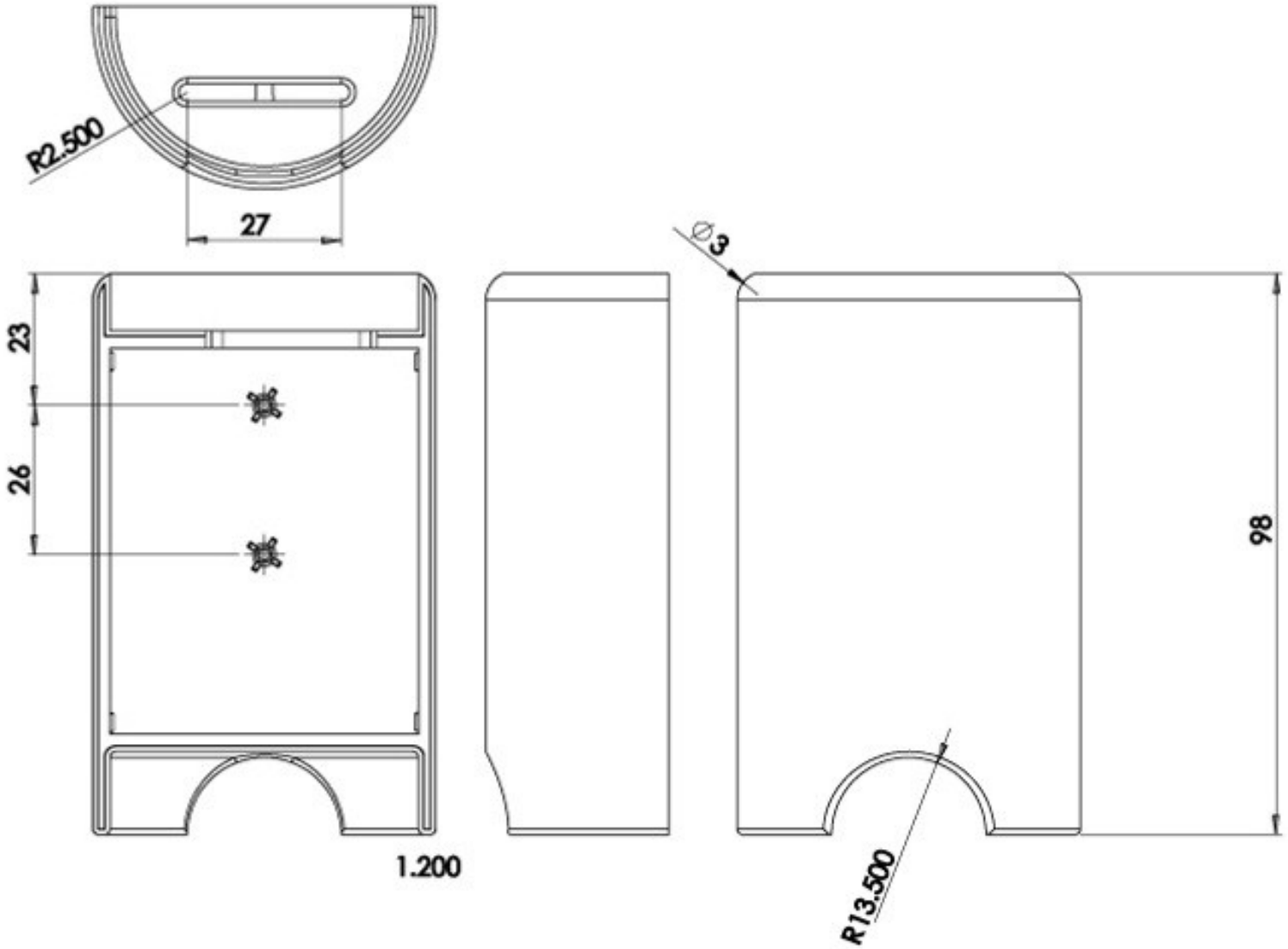
Back of Head



Front of Body



Back of Body



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