https://docs.google.com/presentation/d/1PtGXXW_G1qft4_FWU0LkYdDFkOCWt5_GACYa5F680Cc/edit?usp=sharing

Design OS for an Augmented Reality Motion Sensor I/O Device

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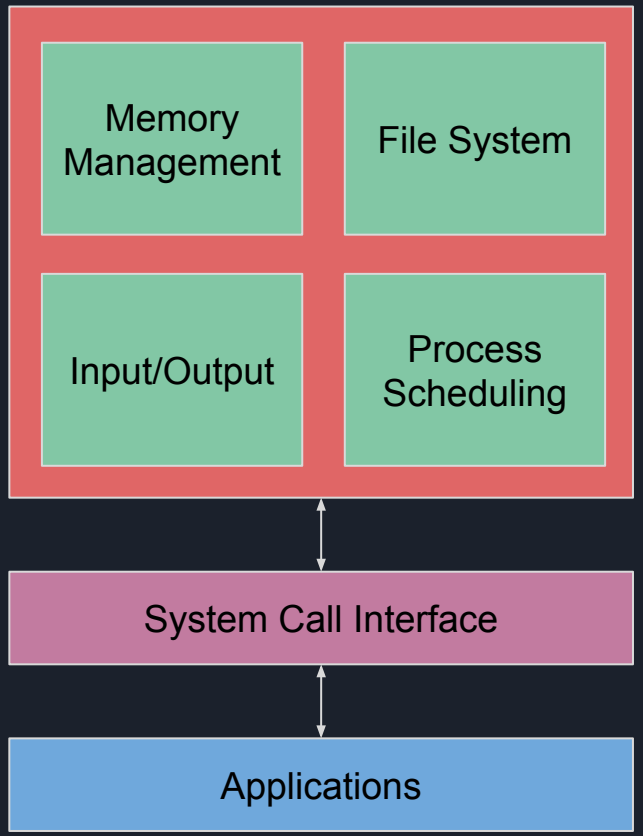
Overview



Interrupt driven architecture.

Puts a priority on the user experience such that there is minimal-to-no interruption of the user experience.

The glasses need to feel snappy, any actions should have an immediate response even if it takes longer to fully complete. If this isn't possible appropriate feedback should be given. The glasses are meant to be a convenience, you shouldn't feel the need to pull out your phone to occupy you whilst something on the glasses loads.

This can be managed through using multiple process queues.

List of Technologies Implemented

- Bluetooth Transmitter
- Motion Sensor Bar
- Bone conduction audio
- Infrared depth finding camera
- Retina projection
- Quad Core Processor
- Internal storage
- microSD Card slot for expandable storage
- Eye tracking

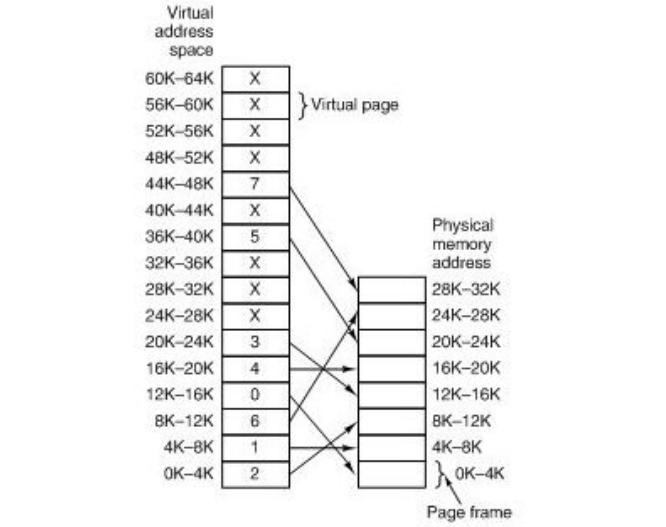
Memory Management

Virtual Memory

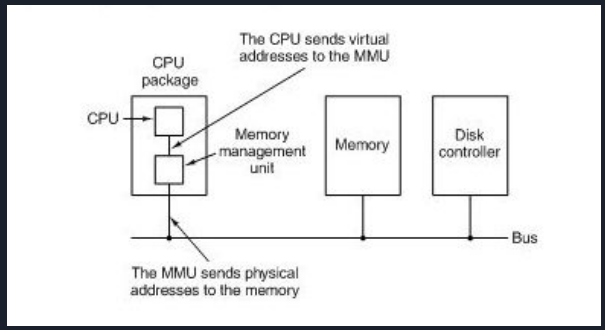
Enables the ARMS device to run its programs, to the capacity which the required program space exceeds the physical memory space.

Each program creates its own virtual address space which is broken up into ‘pages’ of a fixed size which represents a range of addresses.

The pages required to run a program are mapped to the physical memory.



The Main Memory Unit interfaces the CPU with Memory as well as facilitates the mapping between virtual and physical addresses.



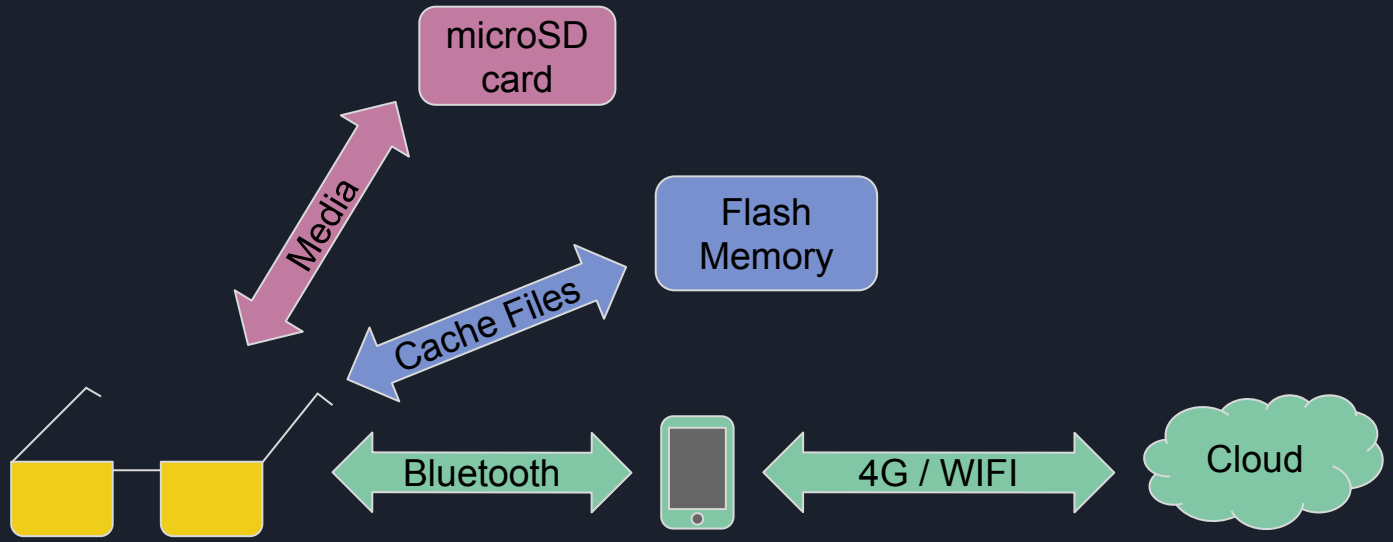
Paging Mechanisms

A paging mechanism allows the ARMS device’s main memory to access data in secondary storage.

ARMSOS implements the Least Recently Used Algorithm.

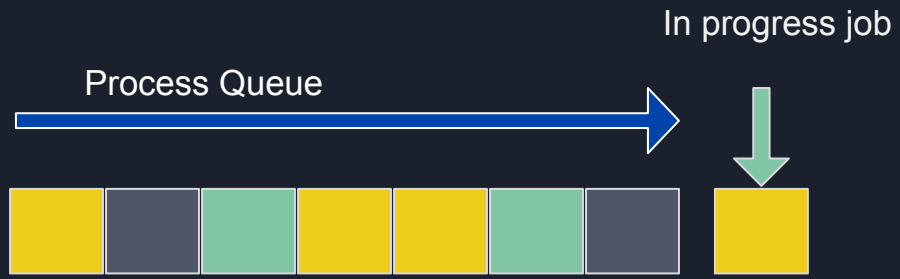
File System

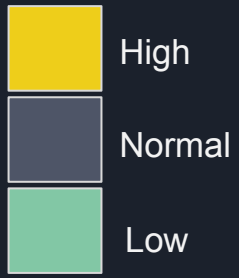
The ARMS device contains a small amount of on board storage in the form of a flash chip and a microSD card. This allows for the offline access of media and programs as well as the use of caching for recently accessed or edited files for quick access while the latest version is downloading.
Checksums can be used to ensure that files are not corrupted during transfer.



Process Scheduling Algorithm

Example Process Queue



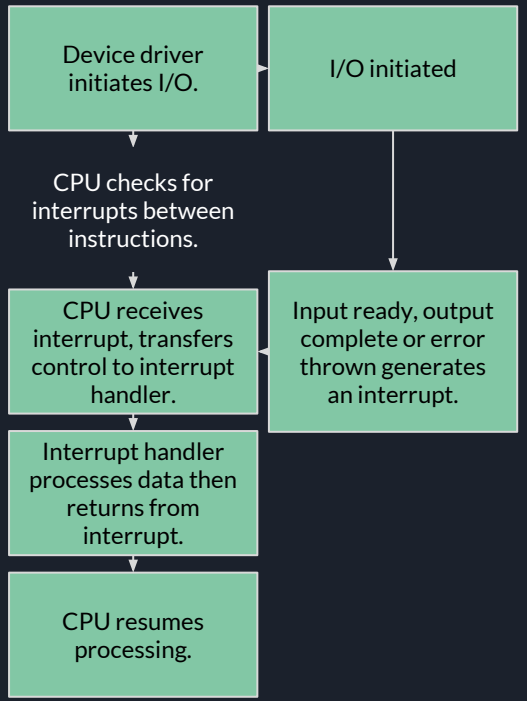


Round robin approach with adjusted time-slices depending on the job priority.

Combines a rapid turnaround of tasks in a way that appreciates that there are tasks of lesser and greater importance.

Maximum Process Lengths
High: 20
Normal: 10
Low: 5

Core Prioritisation and Interrupt-Driven I/O



The ARMS device would contain a quad core mobile processor, with a single core dedicated to the “user experience”.

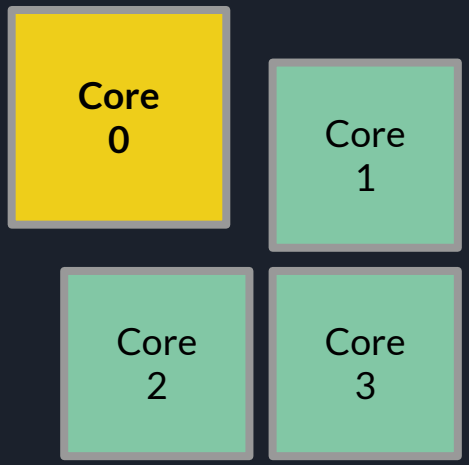
Doing this enables the device to continue running smoothly even if it is being overloaded by other processes.

This is necessary as the device should always be accurately tracking objects on the screen at a high refresh rate otherwise the experience could become nauseating for the user.

Closely linked to this is interrupt-driven I/O.

I/O devices (e.g. the motion sensor or gyroscope) would interrupt the CPU to ensure there is no idle time polling for input.

Combined, this should allow for a smooth user experience with jitter or delay.



I/O - Outputs

Image Source:
http://www.bitpixeltech.com/overview-bone-conduction-headphones/

Bone audio conduction

For any audio that the ARMS device needs to output, we have elected to use a technology called bone conduction. What this does is convert any sound into vibrations which allows users to hear the sounds. It does not insert into the ear and conveniently rests where a pear of glasses would fit.

Retina Projection

Rather than going for a typical glass screen for the device, we are going to use a piece of technology that delivers the image straight into your eye. The image you see would be as if the content is floating in front of you

I/O - General Interaction

Most of the user input uses a combination of both the eye tracking technology and also the use of an infrared depth finding camera.

Interacting with menus or actions such as scrolling and zooming comes from general hand gestures such as swiping or pinching. Much like how you would interact with a phone.

When it comes to clicking on a link or an item in a menu, you would be required to look at said link and perform a hand gesture such as a tapping motion.

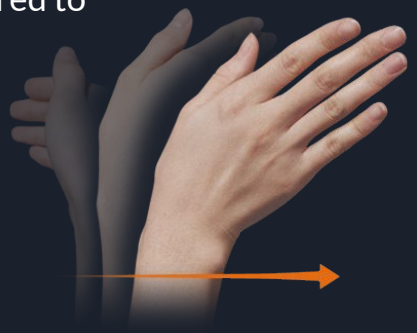


Image Source:
http://www.samsung.com/global/microsite/tv/common/guide_book_5p_vi/flip_right.html

I/O - Keyboard

We are implementing two alternative options when it comes to the keyboard interface, the user can switch between them.

Option One: ‘Projected Keyboard’

This is where a keyboard appears to be projected onto the table in front of you and you can interact by tapping keys with your fingers.

This also includes a ‘lock’ feature for the keyboard where you can lock the keyboard in place, allowing you to look around.

This option is ideal for sitting somewhere that has a workspace in front of you and is ideally the main option for writing large amount of text or documents.

Option Two: ‘Time based eye contact’

This option for the keyboard inputs includes a keyboard appearing floating in front of you. To interact with the keyboard, you must be looking at a key for a certain amount of time for it to be pressed. The default time is 1.75 seconds however this can be changed by the user.

This option is ideal for small amounts of text such as internet searches. It is not recommended for large quantities of typing as it is generally slower than the alternative and could cause some eye strain due to the constant movement of eyes.

App Implementations

Augmented Browser

Function

- Browse the internet.

User Interaction:

- Minimal interface. Non invasive but interactive when in use.
- Gesture and eye movement controls.

Augmented Media Player

Function:

- Browse media library
- Watch movies
- Listen to music
- View photo library

User Interaction:

- Basic file navigation
- Playback controls and media library browsing operated with eye movements.

Augmented Doc Tool

Function:

- Interact with word documents
  - Read
  - Write
  - Edit
- File system access to documents

User Interaction:

- ‘Projected Keyboard’
- Eye tracking utilised for file navigation.

Files are automatically saved to disk as they are written (modifications are also streamed directly to the cloud if a connection is available). This reduces the chance of data being lost as it is simultaneously being saved and backed up.