

# A Camera-based Pointing Interface for Mobile Devices

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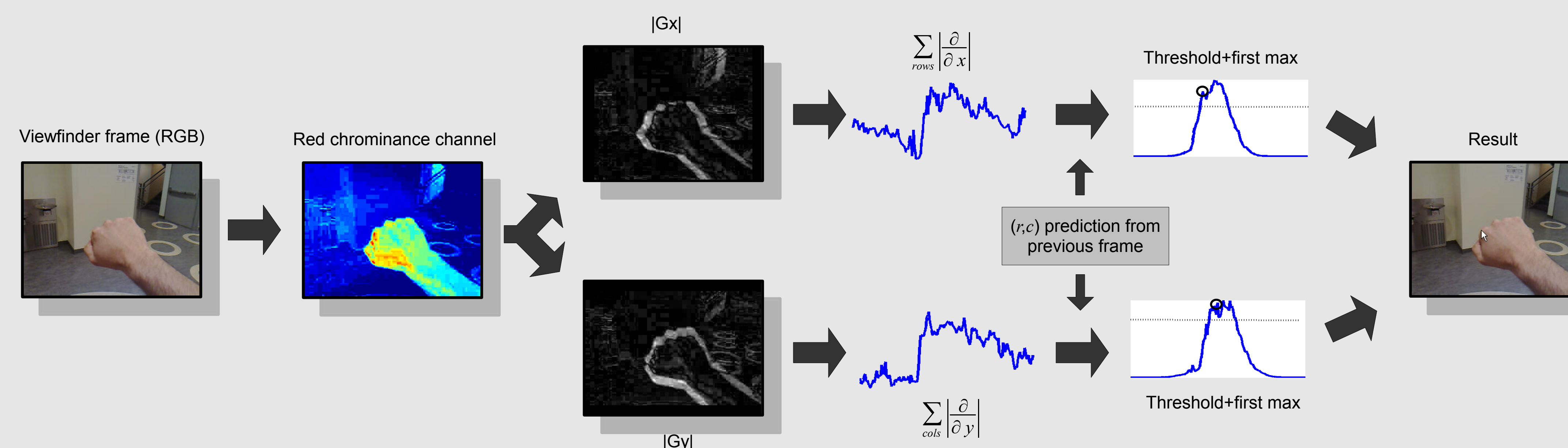
## Motivation

- The choice of the input strategy is becoming the decisive factor for hand-held devices success.
- Solutions requiring dedicated hardware, such as touch-screens, are not applicable to the vast majority of phones currently on the market.
- Cameras are widespread even amongst low-end cellphones.

*We propose a system that allows the user to control the pointer's position by waving a hand in front of the camera.*



## Method

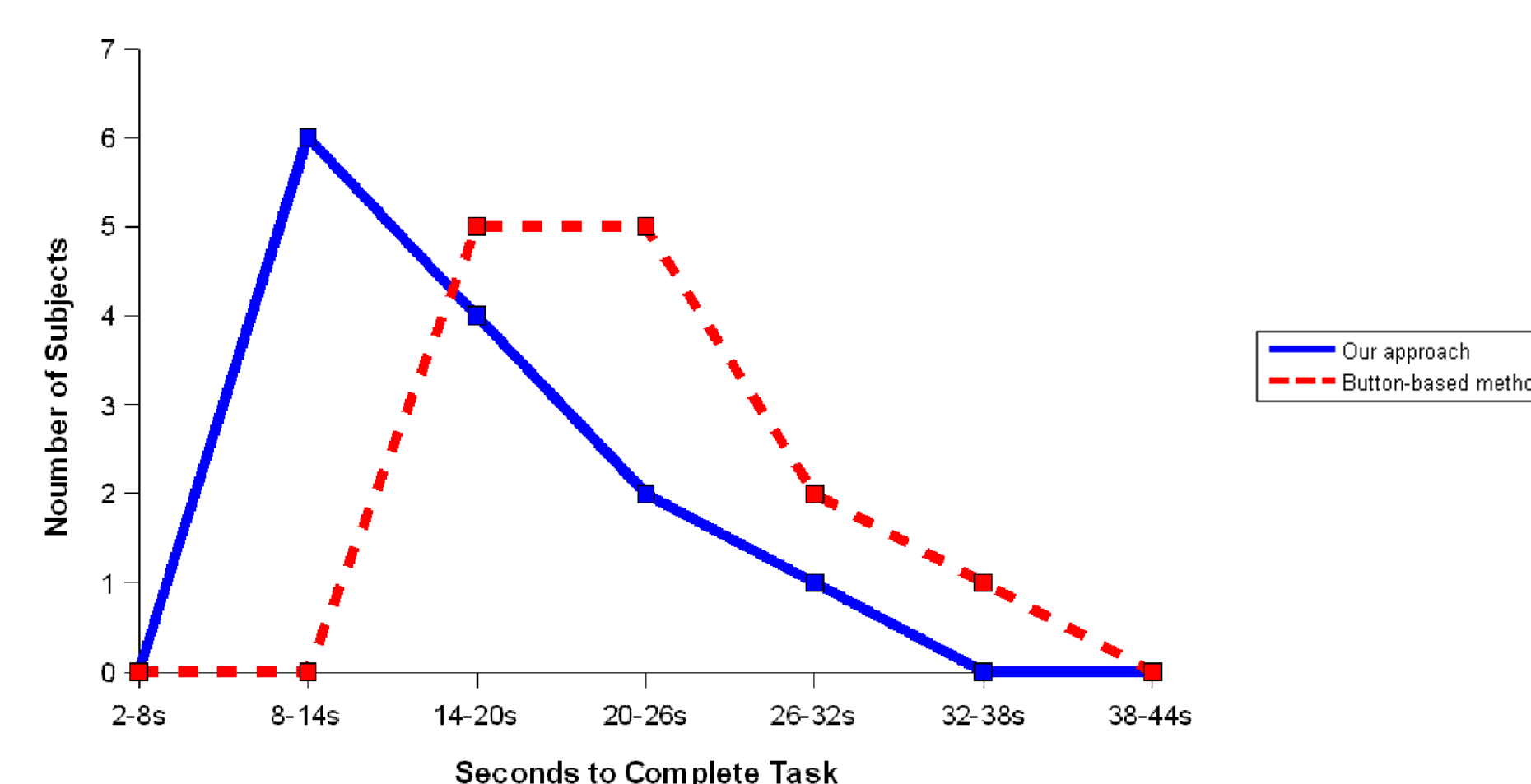


### Implementation

- Implemented on a Nokia N95 cell phone.
- GUI implemented in Python S60.
- Image processing algorithm implemented using Symbian C++, using only fixed point arithmetic.

### Performance

- The viewfinder frame is QVGA, 8bit per channel.
- Algorithm runs at approximately 20 ms on a single viewfinder image (faster than the frame-rate).
- Cluttered backgrounds can be problematic.



## Conclusions

- We proposed a novel pointing interface for mobile devices, which exploits the ubiquity of cameras.
- We designed an algorithm capable of tracking a hand in real-time on uncluttered backgrounds.
- We confirmed the effectiveness of the proposed method with a user study.

## User study

### Experiment setup

Several subjects were asked to count people with red eyes in a picture that was larger than the screen using two different strategies:

- Scroll through the image using the cell-phone keys.
- Scroll through the image by waving their hand in front of the camera.

We measured the time to complete the task.

### Results of the user study

We used a total of thirteen subjects whose completion time is shown in the graph. The average time to complete the task was:

- 16.3s (std 6.1s) with our method.
- 23.2s (std 5.9s) with the phone's keys.

### Acknowledgments

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