

# A Telemedical Interface for At-Home Cognitive Testing

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The **California Cognitive Assessment Battery (CCAB)** is a computerized and automated test battery that allows for at-home or in-lab telemedical testing using a Microsoft Surface Pro tablet. Technical details of CCAB implementation are shown in the accompanying diagram.

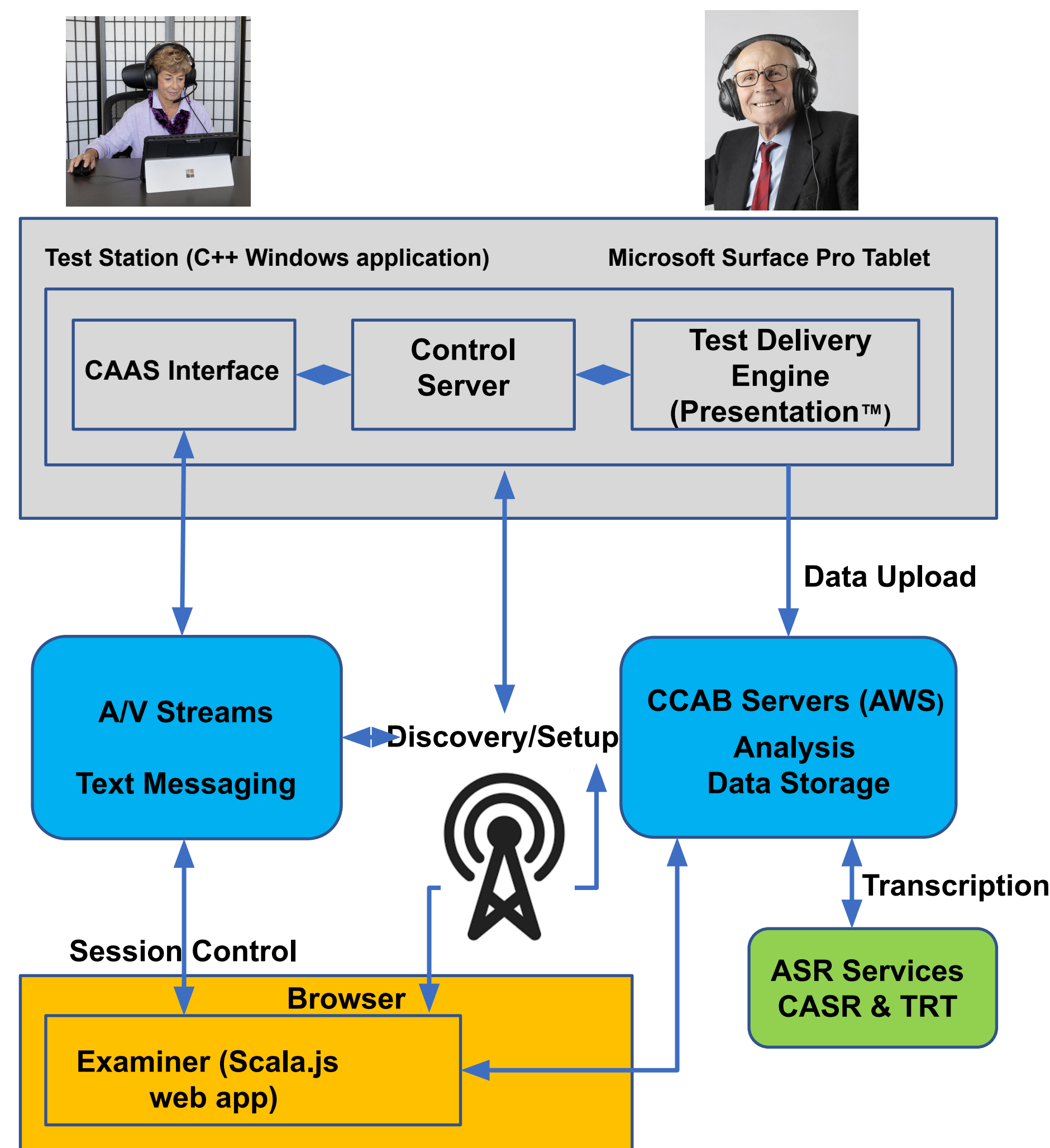
## Why at-home testing?

- **Facilitates recruitment:** Preferred by participants.
- **Reduces selection bias:** Improves access to individuals with mobility and transportation challenges, those in rural areas, and disadvantaged populations.
- **Covid impervious:** Uninterrupted by pandemic lockdowns and constraints.
- **Scalable:** permits nationwide testing.
- **Facilitates scheduling:** Eliminates bottlenecks due to test-room and transportation constraints.
- **Efficient:** Computerized tests enable one examiner to test multiple participants concurrently.

## Overcoming at-home test challenges with the CCAB

- **CCAB cellular connectivity.** Many participants lack broadband connections.
- **Rapport with participants.** The CCAB enables video chats to put participants at ease, establish rapport, and explain procedures.
- **Automated verbal test administration and scoring.** Verbal testing is critical to comprehensive cognitive assessment. The CCAB enables the administration and scoring of the most widely used verbal tests.
- **Participant monitoring and observation.** The CCAB provides continuous audio and video observations during testing and observation-scoring tools.
- **Environmental noise.** Auditory stimuli are delivered through circumaural headphones at calibrated intensities to reduce the influence of background noise.
- **Distractions.** CCAB tests can be halted and readministered by examiners.
- **Multiple participant testing.** Automated examiner alerts of performance failures during training or testing are sent to the control browser window.
- **Precision.** CCAB test stations and tests are calibrated for optimal precision..
- **Easy to start and use.** CCAB tests are clearly explained and start automatically.

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## CCAB results

- **Participants:** 454 participants (mean age 67 years) were assessed in their homes with 72 individual tests over three test sessions (32.8k tests in all).
- **Flawless sessions:** > 75% of participants completed all tests without requiring examiner intervention.
- **Test session failures:** 98.4% of test sessions completed without test failures.
- **Test failures:** 99.3% of tests completed successfully.
- **Cellular connection failures:** Cellular connection failures occurred on < 8% of tests. In 98% of these connection failures the tests completed successfully despite the temporary loss of A/V feeds.

## Conclusions

- The CCAB incorporates multiple quality control features to assure the precision and sensitivity of tests whether administered at-home or in the laboratory.
- At-home CCAB tests show high test/retest reliabilities and results that so far match those obtained from in-laboratory tests.
- At-home CCAB testing facilitates participant recruitment, enables the assessment of individuals with mobility or transportation challenges, and provides nationwide access for all socioeconomic groups, including individuals in remote areas and those with limited technical expertise.

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