SearchSECO: A Worldwide Index of the Software Ecosystem for Cybersecurity (HiTMaT 2021)

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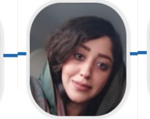

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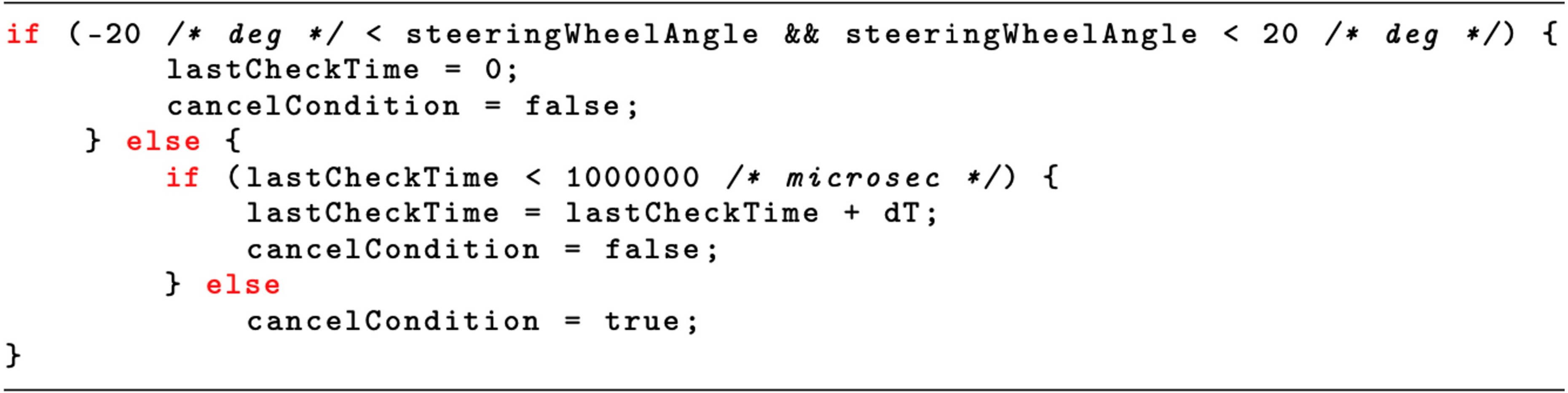
Holland High Tech
Global Challenges, Smart Solutions

Dieselgate: Inspiring Example



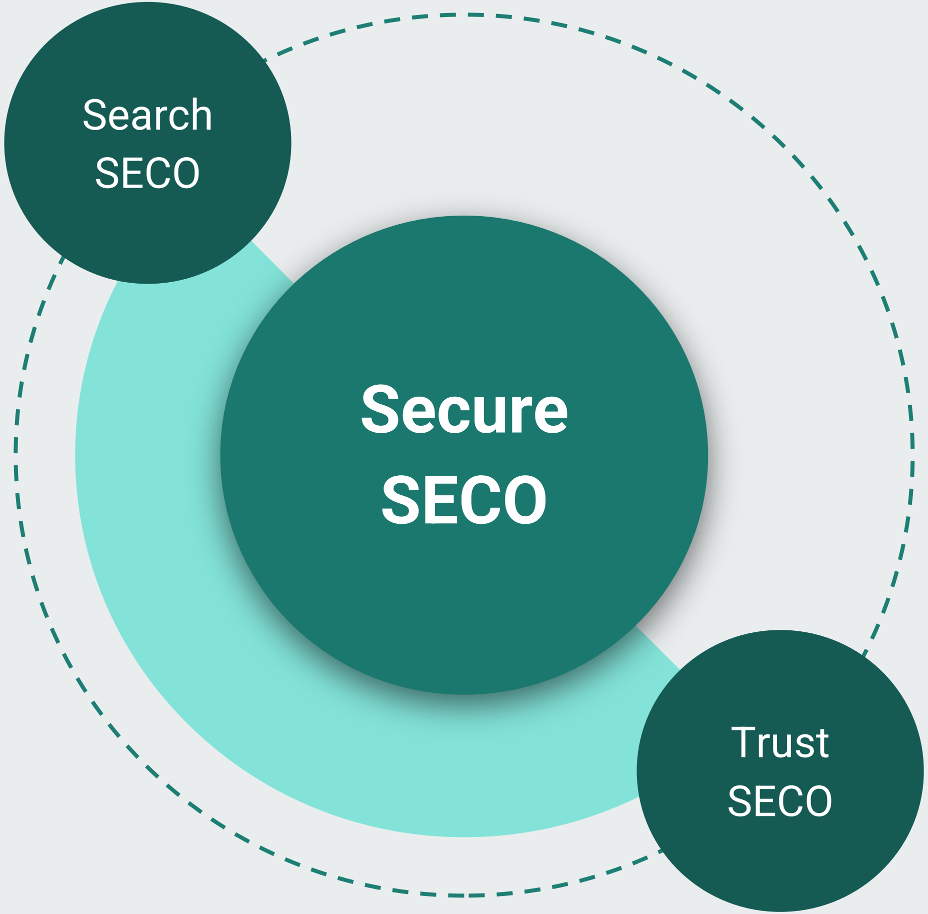
```
if (-20 /* deg */ < steeringWheelAngle && steeringWheelAngle < 20 /* deg */) {
        lastCheckTime = 0;
        cancelCondition = false;
    } else {
        if (lastCheckTime < 1000000 /* microsec */) {
            lastCheckTime = lastCheckTime + dT;
            cancelCondition = false;
        } else
            cancelCondition = true;
}
```

Goal of the SecureSECO Initiative

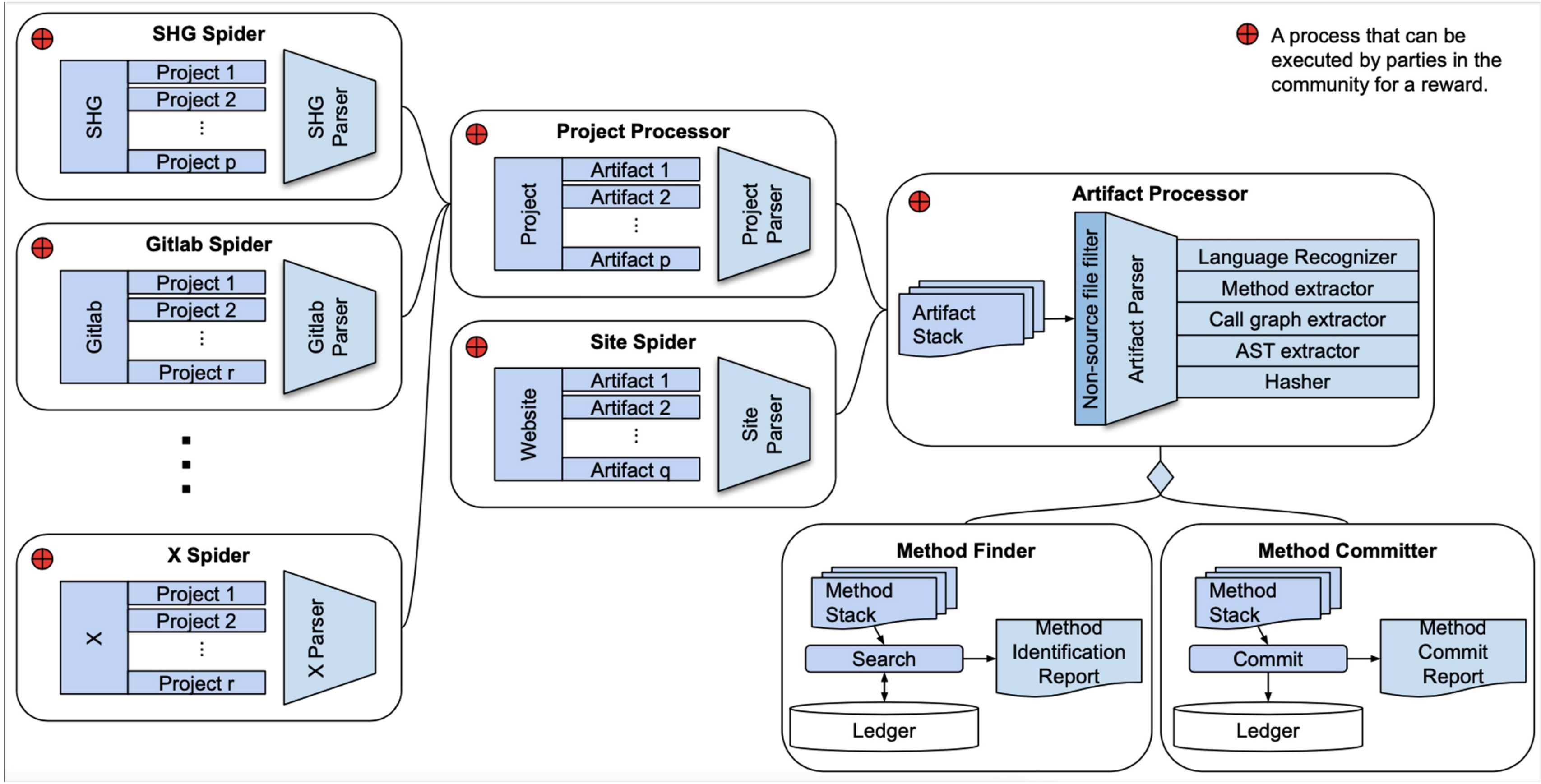
Goal: The *Secure Software Ecosystems* initiative takes **a worldwide scope** on the produced **software that society depends on**. We hunt for software vulnerabilities and propose methods for eliminating them. We collect and analyze data on **why software is to be trusted**.

We subsequently research, design, and build prototype systems that use trust data for **providing trustworthy reliable systems for consumers and industry**.

These systems are frequently underpinned by open distributed systems that provide guarantees for **reliable open untamperable data**.



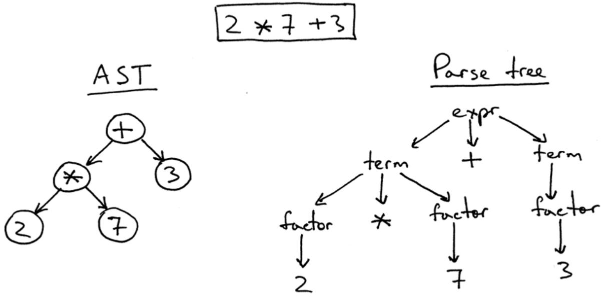
We spider the worldwide software ecosystem

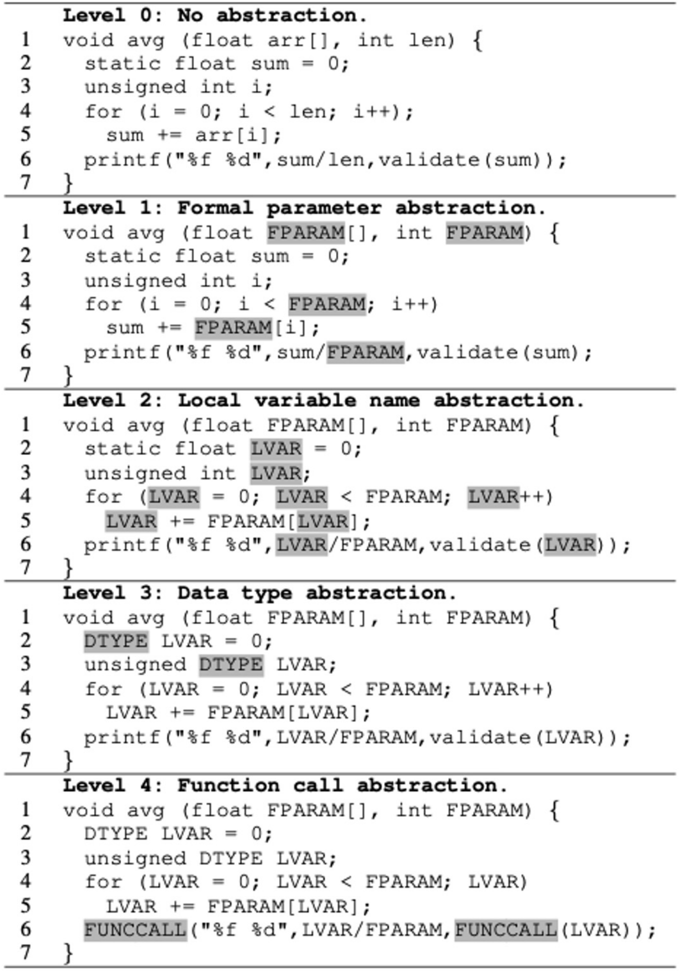


Slinger Jansen, Siamak Farshidi, Georgios Gousios, Joost Visser, Tijs van der Storm, Magiel Bruntink (2020) **SearchSECO: A Worldwide Index of the Open Source Software Ecosystem.** Proceedings of the 19th Belgium-Netherlands Software Evolution Workshop (pdf)

Technique Used: method hashing

- Methods are similar when they have the same parse tree
- We hash an abstract representation of a method, to enable fast searching through the worldwide software ecosystem
- We find clones on a worldwide scale, far larger than the typical project scope





Level 0: No abstraction.

```
void avg (float arr[], int len) {
  static float sum = 0;
  unsigned int i;
  for (i = 0; i < len; i++);
    sum += arr[i];
  printf("%f %d",sum/len,validate(sum));
}
```

Level 1: Formal parameter abstraction.

```
void avg (float FPARAM[], int FPARAM) {
  static float sum = 0;
  unsigned int i;
  for (i = 0; i < FPARAM; i++)
    sum += FPARAM[i];
  printf("%f %d",sum/FPARAM,validate(sum);
}
```

Level 2: Local variable name abstraction.

```
void avg (float FPARAM[], int FPARAM) {
  static float LVAR = 0;
  unsigned int LVAR;
  for (LVAR = 0; LVAR < FPARAM; LVAR++)
    LVAR += FPARAM[LVAR];
  printf("%f %d",LVAR/FPARAM,validate(LVAR));
}
```

Level 3: Data type abstraction.

```
void avg (float FPARAM[], int FPARAM) {
  DTYPE LVAR = 0;
  unsigned DTYPE LVAR;
  for (LVAR = 0; LVAR < FPARAM; LVAR++)
    LVAR += FPARAM[LVAR];
  printf("%f %d",LVAR/FPARAM,validate(LVAR));
}
```

Level 4: Function call abstraction.

```
void avg (float FPARAM[], int FPARAM) {
  DTYPE LVAR = 0;
  unsigned DTYPE LVAR;
  for (LVAR = 0; LVAR < FPARAM; LVAR)
    LVAR += FPARAM[LVAR];
  FUNCCALL("%f %d",LVAR/FPARAM,FUNCCALL(LVAR));
}
```

Fig. 2: Level-by-level application of abstraction schemes on a sample function.

Our Affordances

Relationships between **methods**

- Study method co-evolution across projects
- Weaknesses tracked, fixes propagated

Relationships between **authors**

- Fine grained authorship
- Copy-paste behavior (StackOverflow)

Relationships between **software projects**

- Establish package dependencies and cohesion
- License violations

Current Progress of SearchSECO

- Over 40M methods indexed (10M unique), nearing 70k projects on GitHub

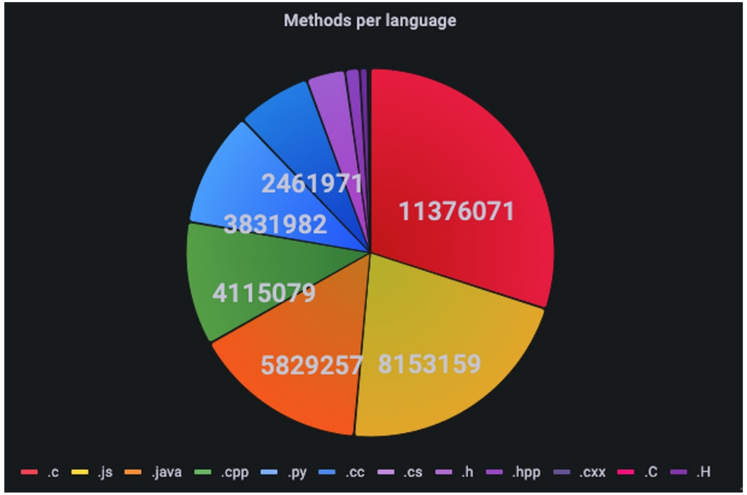
- Including author and license information

- Parsing Python, C(x), Java, and Javascript

- Currently improving performance, so we can “mine” even faster

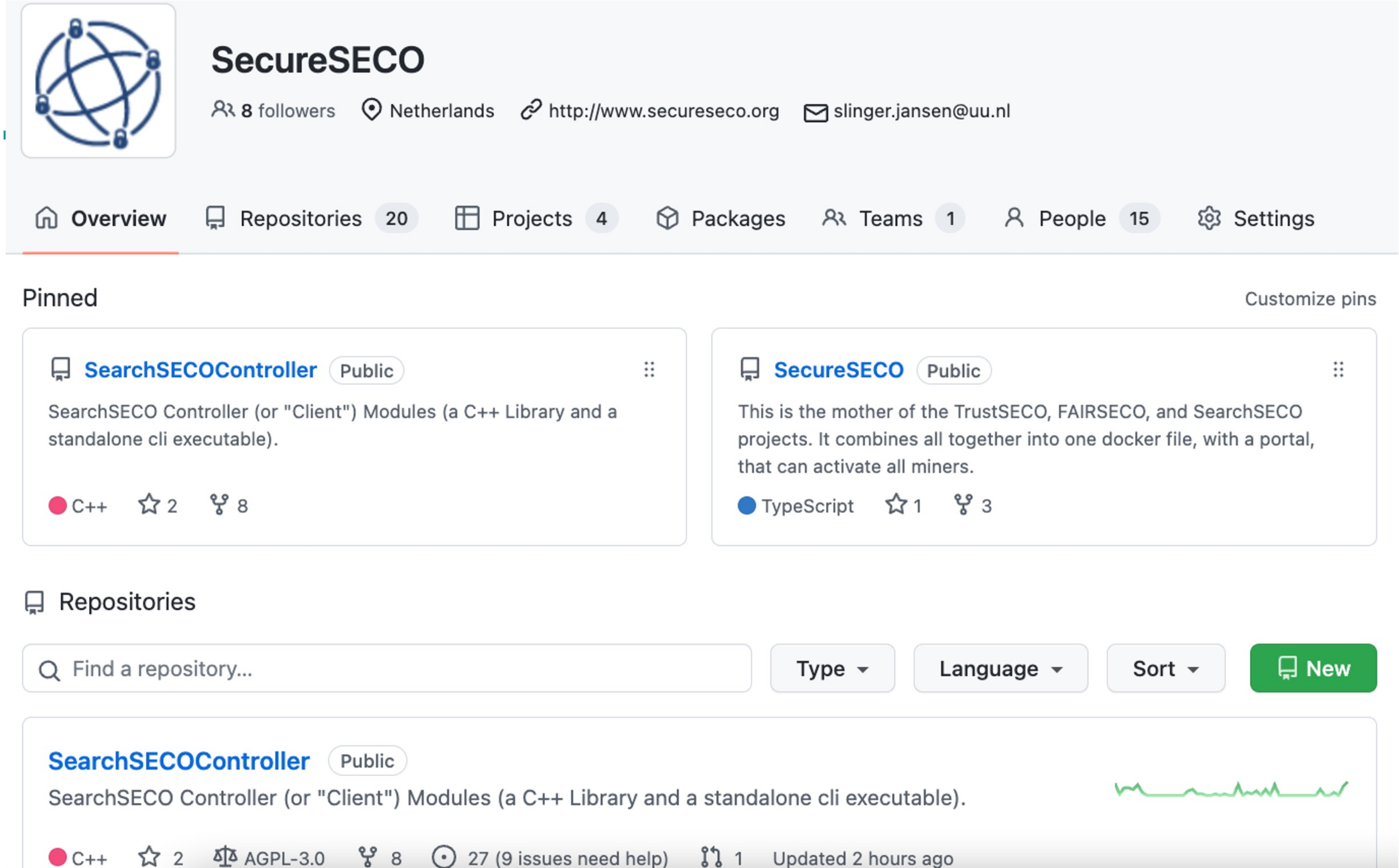
- Thorough consideration of the ethical questions around developer data collection

- Roadmap includes:
  - Advanced method-level license checking
  - “Business model” so that use of the data is paid for with more mining



Follow our progress on https://github.com/SecureSECO/

Active on Github



SecureSECO

8 followers · Netherlands · http://www.secureseco.org · slinger.jansen@uu.nl

Pinned

SearchSECOController Public

SearchSECO Controller (or "Client") Modules (a C++ Library and a standalone cli executable).

● C++ ☆ 2 Forks 8

SecureSECO Public

This is the mother of the TrustSECO, FAIRSECO, and SearchSECO projects. It combines all together into one docker file, with a portal, that can activate all miners.

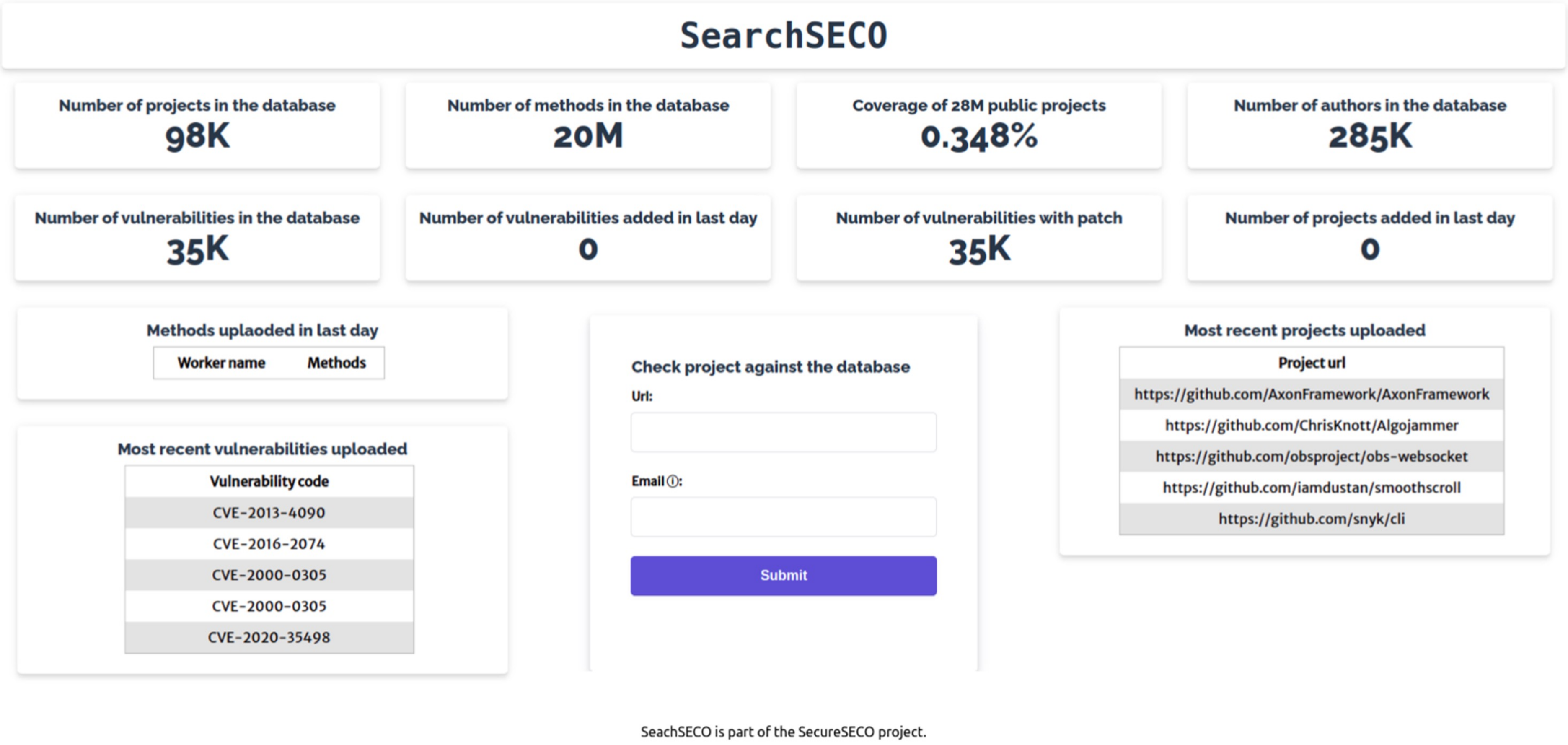
● TypeScript ☆ 1 Forks 3

Repositories

SearchSECOController Public

SearchSECO Controller (or "Client") Modules (a C++ Library and a standalone cli executable).

● C++ ☆ 2 AGPL-3.0 Forks 8 Issues 27 (9 issues need help) Pull requests 1 Updated 2 hours ago



SearchSECO

Number of projects in the database
98K

Number of methods in the database
20M

Coverage of 28M public projects
0.348%

Number of authors in the database
285K

Number of vulnerabilities in the database
35K

Number of vulnerabilities added in last day
0

Number of vulnerabilities with patch
35K

Number of projects added in last day
0

Methods uplaoded in last day

Worker name	Methods

Most recent vulnerabilities uploaded

Vulnerability code
CVE-2013-4090
CVE-2016-2074
CVE-2000-0305
CVE-2000-0305
CVE-2020-35498

Check project against the database

Url:

Email ⓘ:

Most recent projects uploaded

Project url
https://github.com/AxonFramework/AxonFramework
https://github.com/ChrisKnott/Algojammer
https://github.com/obsproject/obs-websocket
https://github.com/iamdustan/smoothscroll
https://github.com/snyk/cli

SeachSECO is part of the SecureSECO project.

https://secureseco.science.uu.nl/portal/

Our own Ecosystem and Opportunities

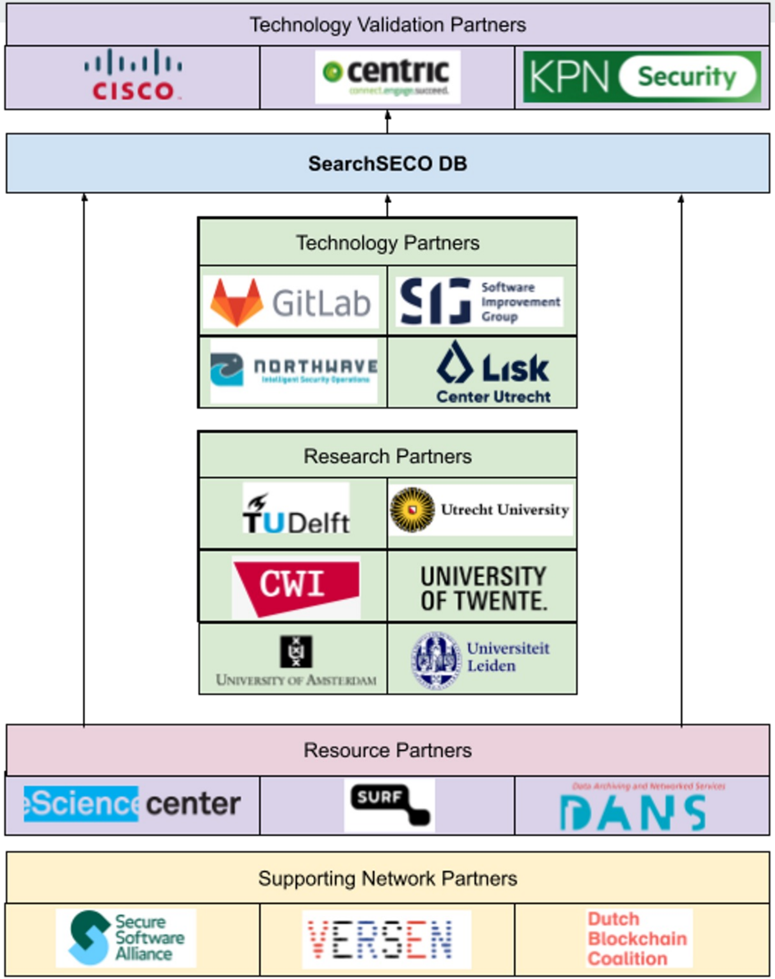
***Opportunity**: Cyber security is increasingly seen as foundational for all computer science students. In relation, there is a windfall coming for the domain of security. We do not want to miss the boat.*

The solutions we offer stem from the research domains of

- empirical software engineering,
- organizational governance,
- distributed ledger technology, and many others.

The research methods we apply are:

- **Qualitative**: Surveys, interviews, case studies, and other empirical methods.
- **Quantitative:** Data analysis, artificial intelligence for big software.



Technology Validation Partners

SearchSECO DB

Technology Partners

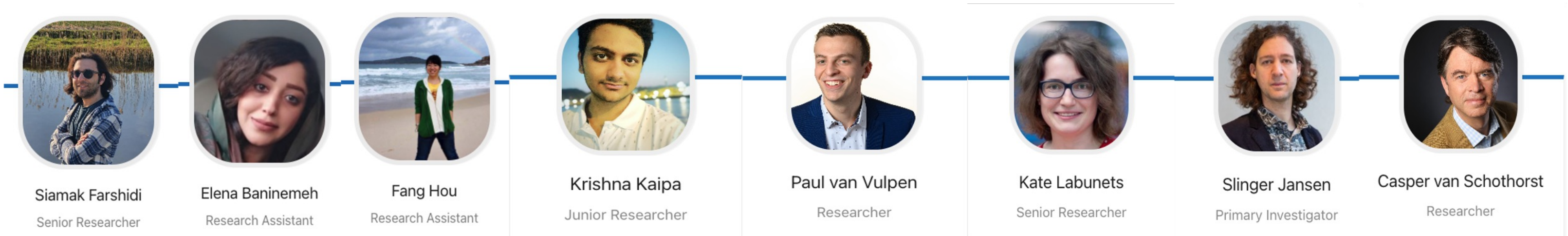
Research Partners

Resource Partners

Supporting Network Partners

In Conclusion

- SecureSECO enables a **safer healthier software ecosystem** for the organizations that take part in it.
- Please go to SecureSECO.org for more information.
- We have an amazing team of PhD, Msc, and Bsc students working on the project.
- Ambitious project goals that create societal and academic impact.
- Actively looking for collaboration and research opportunities.



Current Achievements of the Team

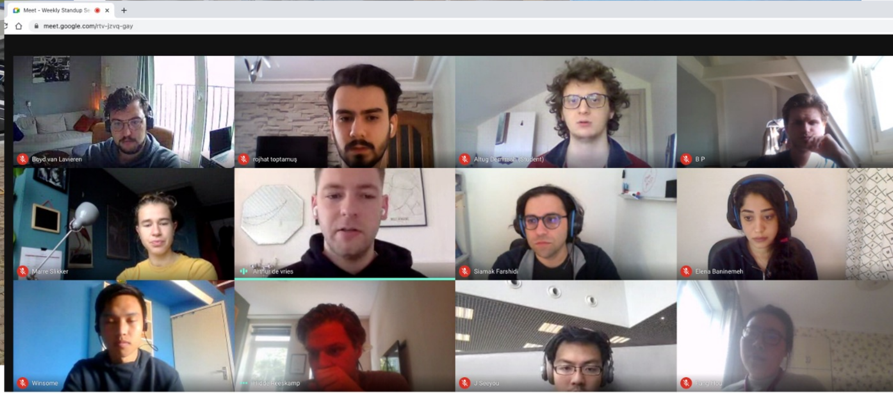
- We have acquired (1)75k euro from TruBlo for exploring trust in the worldwide software ecosystem.
- We have acquired 40k euro funding for exploring whether we can build a startup around this team from NWO
- We have acquired 60k euro funding for conducting several software projects
- We currently have 5 PhD students, 5 Msc students, and 4 Bsc students working on SecureSECO
- Ministry of Defense recently asked *“can you filter out software touched by particular identities?”*
- We have an extensive collaboration with the eScience Center, which recently funded a PhD student
- We won several awards at the Odyssey blockchain hackathon

Recent publications:

- Hou, F., & Jansen, S. (2022). **A Systematic Literature Review on Trust in the Software Ecosystem**. Empirical Software Engineering Journal (draft) (open access)
- Fang Hou, Siamak Farshidi, Slinger Jansen (2021) **TrustSECO: A Distributed Infrastructure for Providing Trust in the Software Ecosystem**. Proceedings of the Workshop on Blockchain for Information Systems Workshop. (open access)
- Slinger Jansen, Siamak Farshidi, Georgios Gousios, Joost Visser, Tijs van der Storm, Magiel Bruntink (2020) **SearchSECO: A Worldwide Index of the Open Source Software Ecosystem**. Proceedings of the 19th Belgium-Netherlands Software Evolution Workshop (pdf) (open access)
- Rowan van Pelt, Slinger Jansen, Sietse Overbeek (2020) **Defining Blockchain Governance: A Framework for Analysis and Comparison**. Information Systems Management. 2020 (pdf) (open access)
- Siamak Farshidi, Slinger Jansen, Sergio Espana, and Jacco Verkleij. **Decision support for blockchain platform selection: Three industry case studies**. IEEE Transactions on Engineering Management, 2020 (pdf). (open access)

And... We have fun!

SECURE SECO
I secured the worldwide software ecosystem and all I got was this lousy t-shirt



Dank voor uw aandacht

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🔗 www.hollandhightech.nl
www.secureseco.org

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Global Challenges, Smart Solutions