SVEUČILIŠTE U ZAGREBU

FAKULTET ORGANIZACIJE I INFORMATIKE

V A R A Ž D I N

PassLock

**PROJEKT IZ KOLEGIJA „Sigurnost informacijskih sustava“**

Varaždin, 2018.

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**GitHub repozitorij:** [**github.com/jkristovi/PassLock**](https://github.com/jkristovi/PassLock)

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Varaždin, prosinac 2018.

Sadržaj

[1. Ideja projekta 1](#_Toc531793200)

[2. Slične aplikacije 2](#_Toc531793201)

[2.1 LastPass 2](#_Toc531793202)

[2.2 KeePass 3](#_Toc531793203)

[2.3 StickyPassword 4](#_Toc531793204)

[3. Korištene tehnologije 5](#_Toc531793205)

[3.1 Visual Studio 2017 (C#, .NET Framework) 5](#_Toc531793206)

[3.2 SQLite 6](#_Toc531793207)

[3.3 SHA256 hash algoritam 7](#_Toc531793208)

[4. PassLock aplikacija 7](#_Toc531793209)

# Ideja projekta

Ideja za ovu aplikaciju je došla iz toga da na kolegiju Sigurnost informacijskih sustava se mora napraviti nekakav praktičan projekt. Sam kolegij je jako zanimljiv, te se moglo jako puno toga naučiti o (ne)sigurnosti stvari i sustava koje svakodnevno koristimo i kojima smo okruženi. Štoviše, naučili smo i da koliko god se zaštitimo, nikad nismo u potpunosti sigurni, te da je najviše što možemo učiniti sa naše strane to da smanjimo sve rizike koje možemo primijetiti na minimum, koristeći neke od mjera opreza.

Nadahnuti tom idejom i misli, odlučili smo se napraviti jednostavnu aplikaciju koja bi mogla svakome od nas povećati mjere opreza, odnosno smanjiti konkretne rizike na jednu nižu razinu – odlučili smo se napraviti **PassLock** aplikaciju.

Svrha ove aplikacije je povećanje sigurnosti na internetu, odnosno korištenje lozinki koje je teško probiti korištenjem nekih tipičnih 'Dictionary Attack' ili sličnih brute force metoda.

Aplikacija omogućuje korisniku izradu popuno prenosive (eng. portable, transferable) SQLite baze podataka koja bi bila zaključana željenom šifrom od minimalno 8 znakova.

Nadalje, korisnik može unositi željene lozinke koje će koristiti pri prijavi u društvene mreže i ostale servise koje svakodnevno koristi, pritom birajući željeni broj znakova pri generiranju lozinke koja će biti pohranjena u SHA256 formatu.

Korisniku je također omogućena i daljnja izmjena generirane lozinke, gdje može mijenjati i dodavati posebne znakove, velika slova (koja su uvjet kod izrade lozinki na pojedinim online servisima), ponovno je kriptirati, brisati i tako dalje. Također, ukoliko to želi, korisnik može i promijeniti lozinku za otvaranje same baze.

Time smo zapravo naše lozinke koje svakodnevno koristimo osigurali ne samo od tipičnih Dictionary Attack metoda, već i organizirali na jedno mjesto što nam daje mogućnost da ih ne moramo pamtiti konstanto, već samo tu jednu koja bi ih sve štitila.

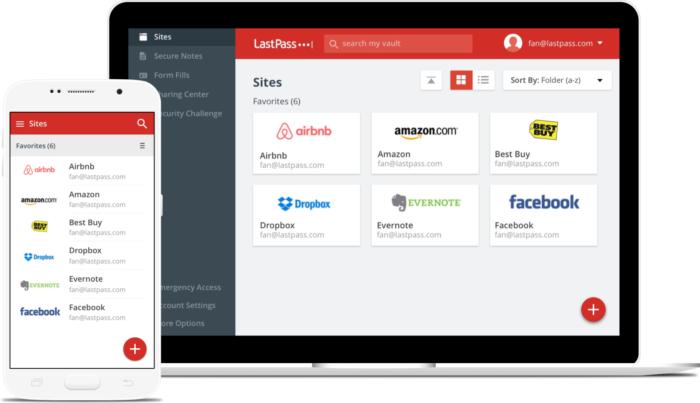
# Slične aplikacije

U daljnjem tekstu će biti prikazane neke slične aplikacije, također će biti prikazane pojedine činjenice aplikacija, tj. koji su njihovi nedostaci, a koje prednosti. Na tržištu postoji veliki broj aplikacija slične našoj, a neke od najpoznatijih i najkorištenijih su sljedeće:

* **LastPass**
* **KeePass**
* **StickyPassword**
* **RoboForm itd.**

Neke od aplikacija su potpuno besplatne, neke pak naplaćuju pojedine funkcionalnosti, a druge se potpuno naplaćuju. Nadalje druge aplikacije nude pohranu lozinki i računa lokalno na računalu, a druge aplikacije omogućuju pohranu podataka na oblaku (engl. Cloud), itd.

## 2.1 LastPass

Prva i jedna od najpoznatijih aplikacija za upravljanjem lozinki i računa je LastPass. Aplikacija koja je dostupna na gotovo svim platformama, Windows, Android, IOS itd., što uvelike olakšava upravljanje velikim brojem digitalnih računa koji se koriste u svakodnevnom životu.

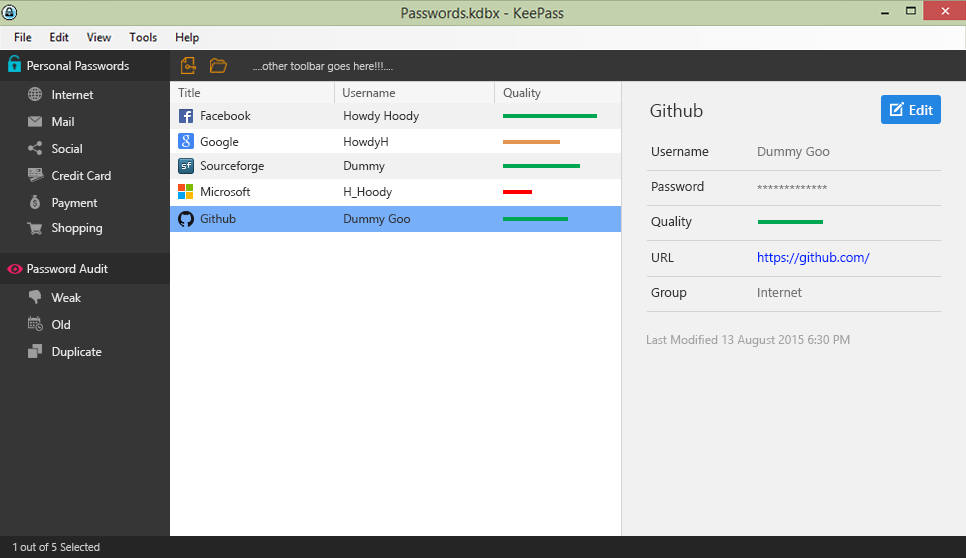
Slika 1. LastPass aplikacija

Nadalje, LastPass omogućuje pohranu lozinki i računa lokano na računalu u jednoj bazi ili pak na njihovim serverima, tj. na Cloudu. Pohrana na računalu je nešto korisnija za one ljude koji koriste samo jedno računalo, a ona verzija s Cloud pohranom je zgodnija za one ljude koji često mijenjaju radno okruženje, ali trebaju imati pristup svojim računima.

Njihov servis nudi veliki broj mogućnosti, a neke od njih su *two-factor authentication, form filling, automatic password capture*, itd. Također omogućuje unos podataka lozinki i računa s raznih Browsera ili pak s drugih aplikacija sličnome LastPass-u.

Nedostatak mu je jedino taj što se naplaćuju njegove usluge što nisu spremni svi korisnici napraviti, te zbog toga postoje neke druge, alternativne aplikacije.

## 2.2 KeePass

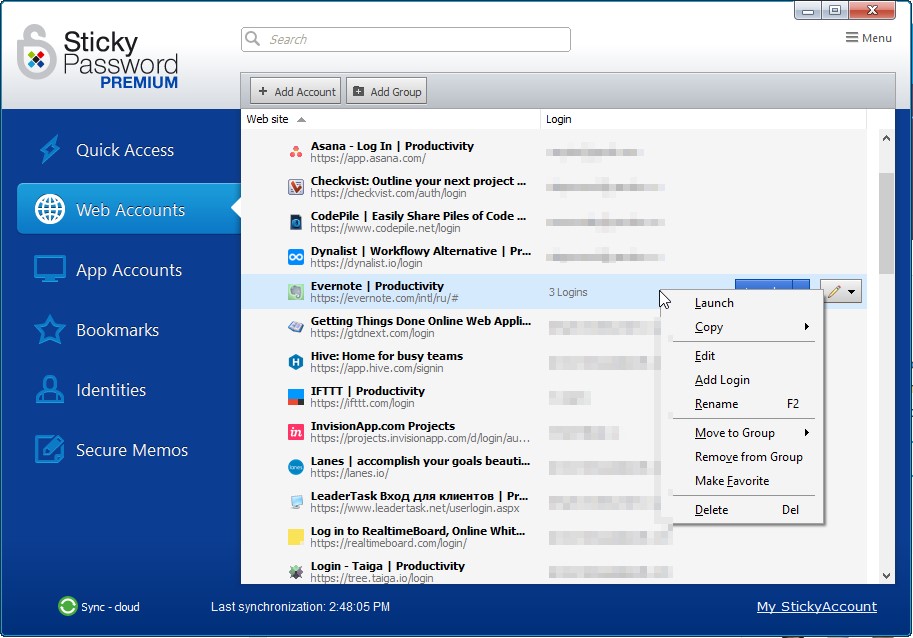
Jedna od besplatnih varijanti upravljanja računima i lozinki je KeePass. KeePass je open source aplikacija vrlo jednostavnog karaktera, koja omogućuje tek ono osnovno, a to je upravljanje računima i lozinki.

Slika 2. KeePass aplikacija

KeePass je zamišljen samo kao alat za pohranu takvih podataka i ništa više, kako čovjek ne bih trebao pamtiti sve te silne podatke. Podaci su pohranjeni lokalno na računalu u jednoj bazi iza koje stoji master račun i lozinka, te je potrebno samo tu jednu lozinku pamtiti kako bi imali pristup svim ostalim računima i lozinkama. Za kriptiranje baze koriste AES I Twofish algoritme, jedne od najsigurnijih algoritama za kriptiranje.

Nedostatak bi bio taj što iza svega stoji samo jedan račun i lozinka, pa ako netko dobi pristup tim podacima, također ima pristup svim ostalim. Osim toga, cijeli projekt je open source što znači da netko može proučiti izvorni kod aplikacije kako bi pronašao neke rupe u njemu i iskoristio ih iako je za time vrlo mala mogućnost.

## 2.3 StickyPassword

Zadnja aplikacija koja će biti opisana je StickyPassword. StickyPassword je vrlo sličan LastPass-u, samo što on nudi nekakve posebne mogućnosti uz samu PasswordManager funkcionalnost.

Slika 3. Sticky Password aplikacija

StickyPassword omogućuje automatsku ispunu obrasca, upravljanje lozinkama, dvostupanjska autentifikacija, generiranje novih sigurnijih lozinki, te omogućuje šifriranje raznih računa na temelju biometrike, tipa prstiju, zjenice i slično.

Nedostak kao i LastPassu je taj da se plaća, no za nekakve najosnovnije funkcionalnosti nije potrebno izdvojiti novac, već se može besplatno koristiti.

# Korištene tehnologije

U sljedećem poglavlju ćemo ukratko opisati tehnologije koje smo koristili prilikom izrade PassLock aplikacije, kao i reći nešto više o samom algoritmu SHA256, koji je korišten pri kriptiranju lozinki.

## 3.1 Visual Studio 2017 (C#, .NET Framework)

![Slika na kojoj se prikazuje isječak crteža

Opis je automatski generiran](data:image/jpeg;base64,/9j/4AAQSkZJRgABAQEAYABgAAD/4R1uRXhpZgAATU0AKgAAAAgABgALAAIAAAAmAAAIYgESAAMAAAABAAEAAAExAAIAAAAmAAAIiAEyAAIAAAAUAAAIrodpAAQAAAABAAAIwuocAAcAAAgMAAAAVgAAEUYc6gAAAAgAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAFdpbmRvd3MgUGhvdG8gRWRpdG9yIDEwLjAuMTAwMTEuMTYzODQAV2luZG93cyBQaG90byBFZGl0b3IgMTAuMC4xMDAxMS4xNjM4NAAyMDE4OjEyOjA1IDE2OjA1OjUzAAAGkAMAAgAAABQAABEckAQAAgAAABQAABEwkpEAAgAAAAMyMgAAkpIAAgAAAAMyMgAAoAEAAwAAAAEAAQAA6hwABwAACAwAAAkQAAAAABzqAAAACAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA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R6RZ+N/FMi+KZp764vVWyndTJLdSOCCFIA+bjBIx3r84gB0YZHXj1/lj2pfl3EsitkrnqOgxgYPHPNP+yaDp8jbbve/UX9mUXDlbd+/U2fG2qQa34z1/UbV/MtbvULi4ifBG5HkZlOCARwR1FW/h78Qta+GHiyx8R6BdNaalaupLD7skY6ow9/WuaXgAUV6/JHl5Htseryrl5XsfqT8Kf2/vhv4+0hLfxYw8KarIojuIb5d9vMcYJDY5UnPUdK0tW8U/sp2JOq3jfD+5mY+Y32a3t7iTJ5OVVCwPsea/KXgtkqp4xnGT+tIu5RgOwHbBrwpZNRTvTm4p9Dx5ZTS5rwk0ux9t/tFft1aRfeHZvBXwosv7J0Ur5Nzq8EH2fFuGwUgjAG0Efxeh6CvSrr9s34S3H7PUvhJPEcg1qTwuNL8hrSY7ZTa+UQWC4OCT9cV+be4leSSdpUn15odmbcM4B9GcEfiGrpeVYfljFX0d79/XQ2eW0eWMV019Rsbbo1PqM9/wCoB/Svur9iP9qj4cfBX4Q3uieLNcNhqEuqy3SRrayvlWWNAMhcf8s859/bn4XJySefxOaNzA8HI9GZz+XzcV24nDQxVP2c3odWIw8cTD2cnod78evFWmeOfjR4x17R7g3Ol6hqUs1vMVK71YnBweRx61xmj6teeHtUtNU0y4kstRtpBJHcRnDDHb6VTwfmIOH2kA+mTnNOOMnAwOwreMVGPIttjojFRiodD9C/gZ/wUc0afSrfSfiXay6dexqEOrWaebbzLjAZ0HKsep5PJPAr1q78ZfsweMh/aN7c+CL2Sb98ZbiGNHYtzlsgHJzzmvyYC/KwyQSc5T5fzx1pTht25VYk55jU/wBOa8WplNGUuam3G/b+v1PInldKUuaDcfQ/VDVf2s/gJ8FNMuE8LPp11c7cLaeHbTJkxwFLAYH15r4X/aM/ai8R/tB6xF56No/huzYtZaOpztz/ABSnA3Nj2GDXiwU7cMFIHQKCv8jS104bLqOHl7TWUu7OjD4Cjh5c6u33YrYycAgdsnJ/Okoor1D0QooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAWNmjcMrlW3BxtONjD7rL/db371+hn7Fn7aqa5/Z3gHx9equpACDS9WlbAnCgKI3OOGAH3s8nsK/PKnRsY5EYMylWDgodrKw6Mp7H+dcWLwsMXT5JfJnJicNDFQ5Jn7zat4m03w7psl9q17b6bZRDL3NzKEjGPc4zXzD8Wv+CiXw98FrPa+GUm8Z6nGWXdbZjs0YEj5pSOcewP1r82PFHxG8UeNktV8Qa/qGsLaxrFCl1OzoiqMDC5x0Fc6zM+CWyR/e6fXHTP4V41DJKcda8r+SPJo5PCOtWV/Q97+KX7bfxO+KErR/wBrDw/pLNkWWkfJlSMbWkOS31wPpXgjMzMWd2kc8l3OWY+pPc0Hk9Sfc4/pSV9BSo06MeWmrI9ynShRXLBWCiiitjUKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKAP//Z) Integrirano razvojno okruženje Visual Studio, kreativna je platforma koja se može koristiti za uređivanje, ispravljanje i izgradnju koda, a zatim i objavljivanje aplikacije, izrađena od strane Microsofta. Visual Studio je bogat program koji se može koristiti za mnoge aspekte razvoja softvera.

Slika 4. Microsoft Visual Studio

Osim standardnog urednika i debuggera koji većina IDE-ova pruža, Visual Studio uključuje kompajlere, alate za dovršavanje koda, grafičke dizajnere i još mnogo toga za olakšavanje procesa razvoja softvera. Neke od važnih značajki koje nudi su:

* **Refactoring** – *uključuje operacije kao što je inteligentno preimenovanje varijabli, vađenje jedne ili više linija koda u novu metodu, promjene redoslijeda parametara metode i još mnogo toga.*
* **IntelliSense** – *pojam za skup značajki koje prikazuju informacije o vašem kodu izavno u uređivaču i, u nekim slučajevima, za vas piše i male dijelove koda.*
* **Quick Actions** – *značajka koja podcrtava potencijalne probleme koje možete riješiti odmah, bez čekanja da se pogreška otkrije tijekom builda ili dok program već radi.*
* **Call Hierarchy** – *značajka koja prikazuje metode koje pozivaju odabranu metodu, može biti jako korisno kada razmišljate o izmjeni ili uklanjanju metode, ili kada pokušavate pronaći potencijalnu grešku.*
* **Code Lens** – *značajka koja vam pomaže da pronađete reference na svoj kod, promjene u kodu, povezane greške, radnje stavke, recenziju koda i testove jedinica, sve bez napuštanja urednika.*
* **Peek Definition** – *značajka koja vam prikazuje definiciju metode ili tipa podataka, bez potrebe da otvarate zasebne datoteke.*

## 3.2 SQLite

SQLite je sustav za upravljanje bazom, sustav kojem nije potreban nikakav server, te sustav koji je vrlo lagan sa sam hardver. SQLite baza je pohranjena u jednoj jedinoj konačnoj datoteci s ekstenzijom .db ili -sqlite, te se u njoj nalazi cjelokupna struktura tablica te podataka koje su u nju pohranjene. Takva datoteka se lako prenosi, lako se njome upravlja i dijeli, te je podržana od velikog broja aplikacija. Osim toga, tu jednu datoteku je moguće zaključati tako da samo određene osobe imaju pristup njoj što je vrlo korisno za naš projekt.

SQLite je pogodan za sustave slabijih performansi, budući da ne koristi nikakve komplicirane algoritme pretraživanja ili obrade podataka, tako da je pogodan za mobilne uređaje, pametne satove i razne druge uređaje.

Slika 5. SQLite

SQLite je također open source projekt, gdje je moguće sudjelovati u razvoju istog ili pak iskoristiti postojeće tehnologije kako bi se izradio neki drugi, bolji sustav.

## 3.3 SHA256 hash algoritam

# PassLock aplikacija