



REVIEW ARTICLE

Building SaaS solutions using microsoft azure for achieving safe and secure tax related software

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Abstract

Microsoft Azure Cloud Platform offers several services for building, running and managing applications. These Services include Azure Active Directory (AD), Azure Virtual Machines (VMs), Azure App Services, Azure DevOps etc have been used to develop this system which can manage all real estate tax servicing needs. It significantly reduces servicing costs with the Tax Outsourcing platform. This system is a SaaS product that many customers request to maintain current tax status on loan portfolios to ensure taxes are paid on time. The contracted loans include tax identification numbers and parcel numbers, current year taxes, back taxes that are past due, information about tax redemption, etc.

Keywords: Agile Scrum Methodology, Sprint, Monorepo, MVC Architecture, auth.2.0, Code Flow, Proof Key for Code Exchange (PKCE).

Introduction

Software as a service (SaaS) is on-demand and cloud-based software that is used to deliver applications (software) to end-users. SaaS products have several benefits such as easy to maintain, access, customizable, scalability etc (Melo, 2021). A tax whose amount is determined by the transactional or property worth is known as a property tax. It is assessed by the body in charge of the area where the property is situated. Real estate is frequently subject to it. It could be levied yearly or at the time of a real estate transaction, like in the case of a real estate transfer tax.

The goal of this website is to provide services to customers for managing tax related information. In Figure 1, the US tax sales rate is shown, indicating the raise in the

percentage of tax rates for the year 2021. Unlike other tax softwares like Acumatica, Oracle Financials Cloud which are used worldwide, this application is solely built for US citizens and it offers customizations with real estate tax status information which includes such tax payment processing involves observation on current year taxes, delinquent taxes, amount needed to pay off delinquent property taxes (Redemption tax information), tax audit (is a collection of audits that examine tax information from the lender's loan servicing system.), tax outsourcing acts on behalf of the lender to pay taxes for all loans and performs other outsource functions.

Here, the proposed work is a website that provides the tax-related services to the customers such as checking the tax related information such as their current year taxes, delinquent tax reporting, tax identification or parcel numbers. Request a bill for current taxes, get the contact information and enquire about their concerns in the tax details. For outsource customers, it will act on the behalf of the lender in paying taxes, answering the borrower calls as the lender and performing other outsource services.

This web application is intended for providing tax related services to the customers. The final product is a web application where the agency members, and customers can sign into their respective accounts; depending on the user the landing page differs. The agency members can view the stats for new contracts, task status, delinquent tax status, the number of payments completed and pending payments, view the total number of applied tax lines, rejected tax lines, rejected payments etc. The customers can view their tax

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How to cite this article: Sivamani, S., Kondareddy, R., Ayyemperumal, K. (2023). Building SaaS solutions using microsoft azure for achieving safe and secure tax related software. The Scientific Temper, 14(2):521-526.

Doi: 10.58414/SCIENTIFICTEMPER.2023.14.2.45

Source of support: Nil

Conflict of interest: None.

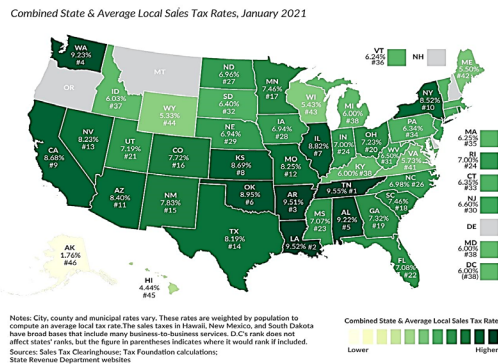


Figure 1: Tax sales rate in US

related information such as current tax payments, due dates for paying taxes, report if the information is incorrect etc.

Technology Overview

Agile Scrum Methodology is the approach used in developing this web application (Peek, 2023). It is an incremental development-based sprint-based project management system. There are two to four sprints included in each iteration. Here, the goal of each sprint included in an iteration is to build the key features first and produce a product that is ultimately deliverable. The ability of this method is used to provide project work with high-end collaboration and efficiency.

Agile is a method that encourages groups to create projects with greater efficiency by segmenting them into several phases.

Scrum is a type of agile technology that promotes cross-functional teams. It is known for breaking projects down into sizable chunks called sprints.

Jira software is used as a project tracking and agile software development tool that supports any agile methodology. It is used in this project along with Bitbucket. Jira and Bitbucket help in providing a strong integration of project management.

The graphical representation of a system's workflow is a system flow diagram. It shows how information moves through a system and how choices are made to direct events.

In Figure 2, the system flow diagram of the application is shown. It is the graphical representation of the workflow of the system.

This web application is built using Angular as front-end, .NET Core application as API Backend, and Microsoft SQL Server as the database (Saini & Arora, 2021; ASP.NET documentation, 2022). The angular application is deployed to Azure storage account and a .NET Core application to Azure app service residing in a single Bitbucket Repository.

N-TIER Architecture

An N-tier architecture would be used to segment a three-tiered application. They are:

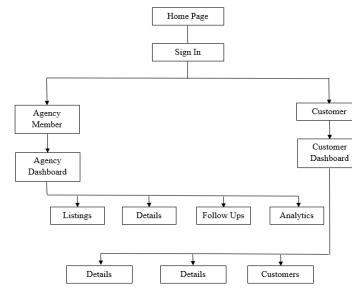


Figure 2: System flow diagram

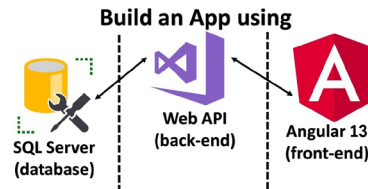


Figure 3: Building an application using (Angular-Web API-SQL Server)

- Presentation Tier
- Application Tier
- Data Tier

In Figure 4, the N-Tier Architecture Diagram is shown. It is a software architecture model which is industry-proven. It provides solutions to fault tolerance, maintainability, scalability, security and reusability, making it suitable to support enterprise-level client-server applications. It is useful for developers to create flexible and reusable applications.

The Presentation Tier is the highest level of the user interface for the system, and its primary purpose is to interpret actions and results into terms that the user can comprehend.

- The three-tier system's presentation tier, or client-end layer, consists of the graphical interface.
- The material and information displayed on this graphical interface, which is frequently graphical and viewable through an internet browser or web-based application, are all beneficial to the client.
- The system makes use of Angular.

The Application Tier executes orders and performs evaluations and logical choices. It includes the operational business logic that powers an application's essential features.

- C#, C++, Java, JavaScript, Python, etc. are frequently used.
- In this application, C# is used.

Data Tier is employed to keep and retrieve information from a file system or database..

- The data tier is composed of the databases or system for storing information and the data access layer.
- These systems include Firebase, Microsoft SQL, MongoDB, MySQL, Oracle, and PostgreSQL.
- This system make use of Microsoft SQL.



Figure 4: N-Tier architecture diagram

The benefits of using 3-tier architecture are given below.

- Here, scalability is the ability of the web-based application to handle an increase in users and load, without disrupting the end users.
- Here, Performance is better as the response time to the user's request is taken care of in less time.
- Different layers of an application can be modularized, which allows development teams to create and improve a product more quickly than using a single code base.
- There is minimal impact on the other layers while upgrading a specific layer.
- Allowing teams to concentrate on their core talents can help increase the efficiency of development.

Every project's code and assets are kept in a single repository called a MonoRepo (mono repository) (Fernandez, 2022). A monorepo is a single repository that contains various programmes and libraries, according to the most basic description. Everything comes with a set of tools that make it possible for us to work on the projects.

While a multirepo (many repositories) normally maintain one repository for each project, a monorepo (one repository) keeps everything in one repository.

There are more repositories as there are projects. MonoRepo assists in preventing the need to rebuild or retest each project in the monorepo whenever an application change is made. The projects that the change might impact should instead be rebuilt and tested again.

MonoRepo in angular can be created using NX workspace (Nx Documentation, 2022). It is a collection of tools made to engineer, construct, and manage MonoRepo at any scale. It supports a variety of backend technologies, including as Express, Next, and Nest, as well as front-end frameworks like Angular and React.

The core of Nx is generic and simple with plugins available that are completely optional. Nx helps us to achieve

- One build setup (on Angular CLI here)
- Code editors and IDEs to become "workspace" aware.
- apps/ contains the application projects
- libs/ contains the library projects

```

1 MyOrg/
2   └─ apps/
3   └─ libs/
4   └─ tools/
5   └─ workspace.json
6   └─ nx.json
7   └─ package.json
8   └─ tsconfig.base.json

```

Figure 5: Sample folder structure

- tools/ contains scripts that act on the code base
- workspace.json lists every project in the workspace
- nx.json configures the Nx CLI itself. It tells Nx what needs to be cached, how to run tasks etc.

Project source code is stored in Bitbucket. It acts as a central place for managing the git repositories.

A Microsoft Software as a Service (SaaS) platform called Azure DevOps offers an entire DevOps toolchain for creating and distributing software (Simplilearn, 2021). Azure DevOps is utilised in this situation to automate the build and release procedures of the product being produced, which allows us to concentrate more on the development portion.

The .NET Core application utilizes the Model-View-Controller (MVC) architecture. The presentation specifics and the business logic used to be separate. In software development, the MVC paradigm is used to implement user interfaces, data, and controlling logic.

The three components of the MVC software design pattern are as follows:

- **Model** – controls business logic and data
- **View** – layout and presentation
- **Controller** – orders are routed to the model and parts are seen

Model-View-Controller

Since, the main feature of any web-based software is to be portable. The use of Angular framework makes the software cross platform, easy to scale and it is also browser independent. By using OAuth 2.0 Authorization code flow (with PKCE) [7] in Microsoft Azure Active Directory (AD)

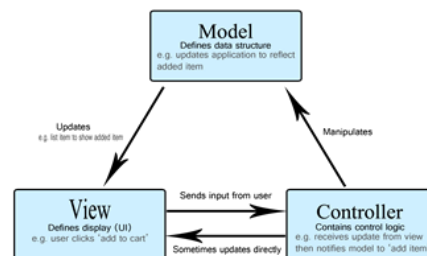


Figure 6: MVC

the website is secure to use and protected from hackers (Silverman, 2019).

Unit testing [8] is done to ensure that a section of an application meets its design and behaves as intended. Here, Xunit is used as a unit testing tool for testing purposes (Petersen, 2021).

Property Taxes

The state defines property as real estate ("real property"), mobile homes, business furniture, boats, property fixtures, and other property. Real property is land, or an improvement (building) attached to land. The state also establishes the property tax rate to be applied to the assessed value of the real property.

A real property tax is a charge that a taxing jurisdiction, as specified by the state, imposes on a homeowner's real property. Property taxes used to be often levied on many forms of wealth. Today, however, fixed improvements, such as structures or mobile homes that are fastened to the land, are taxed under the real property tax system.

A personal property tax is a tax levied on mobile homes, business furniture, boats, property fixtures and other property. Generally, a tax service does not report these taxes unless a lien is placed on the real property, such as a mobile home with delinquencies.

Property Tax Calculation

Two crucial metrics are used to determine property tax using the most popular method:

- The basic taxable value of the property that will be taxed is the assessed value of the property (land and improvements).
- The actual tax rate imposed on the property's assessed value is known as the property tax rate or millage rate.

For example, let's say the property tax rate is 1.25%. A home with an assessed value of \$400,000 would have annual property tax of \$5,000.00.

Implementation

The modules involved in the system areas follows:

Authentication Module

The authentication is done by the Microsoft Azure Active Directory (AD) and consumes secured data from Azure API Management (Azure API Management, 2022). Azure AD App registrations are used to configure and set up the authentication and authorization (Simplilearn, 2021). The Angular application uses the following:

- Open ID connect - built-in identification layer over the OAuth 2.0 protocol. It enables the customer to check the end-identity user's identity using the authentication performed by an Authorization Server and access the end-profile user's information.
- OAuth 2.0 is a protocol that allows a user to grant access to secured resources to a third-party website

or application without revealing their permanent credentials or identity.

- PKCE - is proof of possession. The client app must present proof that the authorization code belongs to it so the authorization server can grant it an access token.
- Azure API Management - is a multi-cloud, hybrid platform for managing APIs in all contexts (Mejia, 2022)

There is no sign-up process involved.

The authorization code flow makes the exchange of an authorization code for ID tokens to represent authenticated users and Access tokens required to contact protected APIs made available through Azure API management. Additionally, it provides users with long-term access to resources without forcing them to engage with those resources by returning Refresh tokens.

Agency module

Agency members who signed are redirected to the Agency dashboard by default. It contains an interactive map section which, upon hover displays the status details of Tax Payment in each state (USA), there is a section for notifications that displays the recent updates and a chart showing the status of the Agency update. A nav-menu contains a list of submenus, each of which will display agency-related information upon selection.

Listing is next to the dashboard which is shown in Figure 5, it contains details such as Agency Name, Last Updated, No. of Insts, Agency Contact, Phone Number, Type of Agency, Location, Auto or Manual, Current Year Tax, and Current Installment.

The Details menu is next to the listing menu and it has sub-menus for agency related activities.

The List of sub-menus are as follows,

- Agency Information
- Agency Bill Request
- Agency Current Payments
- Agency Prior Payments
- Agency Calendar
- Agency Notes

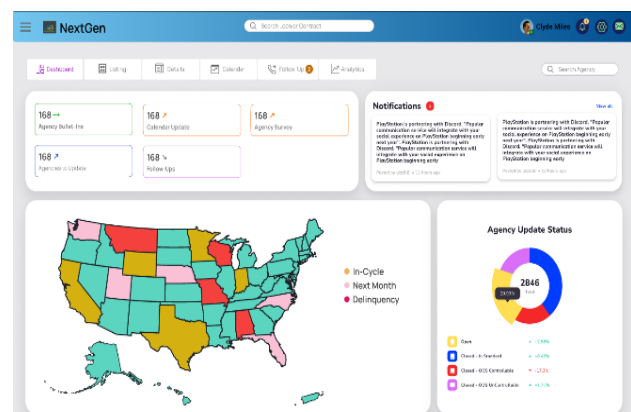


Figure 7: Agency dashboard

The details used in the listing menu along with additional details can be found in Agency information shown in Figure 6. The additional details include Equal Installment, Year Type, EFT Required, EFT Fee, DBF, Tax Year End, Payment Frequency, Late Release, HO Obligations, Hour of Operation, Last Reviewed Date, Reviewed By, Contact Details, Servicer Details, Accessor Address and Recorder Address.

In Figure 7, Agency Bill Request contains fields for Tax Bill/Pay Identification, Bill Request Address, Output Medium Requirements and Parcel Requirements.

Agency Current Payments shown in Figure 8 has similar fields in Prior Payments such as General Requirements, Payee Address, Payment Requirements etc. Only the data entry differs depending upon the agency needs. Redeem Comments are only needed in prior payments.

In Figure 9, Agency Notes include notes (information) used by the agency members.

Agency Calendar includes dates and timing for agency activities.

Customer Module

Customers who signed are redirected to the Customer dashboard by default as shown in Figure 10. It includes information about the customer, including their first, middle, and last names, phone number, address, and email address, as well as their lender ID, lender name, lender details, agency in-charge information, and more.

The details is the next menu which is shown in Figure 11-13. It has the tax related details of the customer such as current tax amount, delinquent tax amount, due date etc.

Figure 10: Agency current payment

Figure 11: Agency notes

Figure 12: Customer dashboard

Figure 8: Agency Information

Figure 9: Agency bill request

Figure 13: Customer information

Conclusion

This web application will be helpful for the customers who demand to maintain tax status thereby helping the customer pay the taxes on time.

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