**HO CHI MINH CITY UNIVERSITY OF TECHNOLOGY AND EDUCATION**

**FACULTY FOR HIGH QUALITY TRAINING**

**INFORMATION TECHNOLOGY**

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**THE PROJECT 2 REPORT**

**BUILDING A CLOUD SURVEY APP**

**LECTURE NAME: M.Sc. Nguyen Duc Khoan**

**STUDENT NAME ID**

**Tran Tan Quy 16110196**

**Nguyen Mai Hung 16110098**

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**LECTURER COMMENT**

Signature

**M.Sc. Nguyen Duc Khoan**

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**LIST OF ACRONYMS**

- IVR: Interactive Voice Response

- PSTN: Public Switched Telephone Network

- POTS: Plain Old Telephone Service

- SIP: Session Initiation Protocol

- VoIP: Voice over Internet Protocol

- OS: operating system

- SSRS: SQL Server Reporting Services

- API: Application Programming Interface

- UI: User interface(s)

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# ***1. Project description***

In every service that we use nowadays, we always want the best service quality for every single service and every company also wants to improve their service quality as best as they can, especially customer services. Recognizing the needs, we are building a system that can help those companies to meet their needs. Our main targets that we are aiming to are call centers which don’t have a way to get customers feedbacks about their service.

**What is call center?**

Call center is a centralized office used for receiving and transmitting a huge amount of calls by telephone, their primary employees called ‘agents’. Agent is the person who takes responsibility for answering calls from their customers. So technically, every agent’s performance for every call will decide their service quality. The better agent’s performance, the better their service quality.

To improve the service quality, they might need something that can help them gather feedbacks from their customers about agent’s performance after every call so we are building ‘Cloud Survey App’ to help them do it.

## **Objective**

Cloud Survey App will allow call center to register to use its services via the web app. They can create/customize a survey, which is an interactive voice response (IVR) so that they can use this survey to gather feedbacks from customer after every call. After an agent or a customer hangs up a call, the survey will play and ask customer to rate an agent whom they just spoke with. Call center can base on the rating report to check agent’s performance.

## **1.2. User requirements**

- Call center can publish, modify IP address, agents information and devices information of their call center to use Cloud Survey App services.

- Call center can create/customize their survey which will be used for gathering feedbacks from their customers. They must be able to upload audio file in order to create the IVR survey.

- Call center can view rating reports of agents in order to increase their service quality.

- Call center’s customers can answer and interact with the survey to rate agent.  
E.g: press button 1 on phone to rate 1 star for the agent.

## **1.3. Usecase diagram**



Image 1. Usecase diagram

## **1.4. Usecase description tables**

Table 1. Usecase login website description

|  |  |  |  |
| --- | --- | --- | --- |
| Usecase name | Login website | | |
| Description | Allow user to log in the web app | | |
| Actor | Unauthorized user | | |
| Business event | No. | Agent | System response |
|  | 1 | Access the web app. |  |
|  | 2 | Click ‘Sign in’ button. |  |
|  | 3 |  | Show login interface. |
|  | 4 | Enter username and pass word then click ‘login’ button. |  |
|  | 5 |  | Process username password and forward to main UI. |
| Preconditions | - Must have an account.  - Internet connection required. | | |
| Condition affecting termination outcome | - When user signs in successfully, show the main homepage and functions.  - When user signs in fail, show error. | | |

Table 2. Usecase register account description

|  |  |  |  |
| --- | --- | --- | --- |
| Usecase name | Register account | | |
| Description | Allow user to register a new account to login and use the services. | | |
| Actor | Unauthorized user | | |
| Business event | No. | Agent | System response |
|  | 1 | Access the web app. |  |
|  | 2 | Click ‘Sign up’ button. |  |
|  | 3 |  | Show register interface. |
|  | 4 | Input information to the register form. |  |
|  | 5 | Click ‘Sign up’ button to create account. |  |
| Preconditions | - Password must be strong.  - Internet connection required. | | |
| Condition affecting termination outcome | - When user signs up successfully, show ‘Sign in’ interface for user to sign in.  - When user signs up fail, show error. | | |

Table 3. Usecase Manage IP address description

|  |  |  |  |
| --- | --- | --- | --- |
| Usecase name | Manage IP address | | |
| Description | User can configure IP address of their call center | | |
| Actor | User as known as Call center | | |
| Business event | No. | Agent | System response |
|  | 1 | Access the web app. |  |
|  | 2 | Log in the web app. |  |
|  | 3 | Click ‘Configuration’ button on homepage. |  |
|  | 4 |  | Show ‘Configuration’ page. |
|  | 5 | Choose ‘Domain’ tab. |  |
|  | 6 |  | Show IP address input. |
| Preconditions | - User logged in successfully.  - Internet connection required | | |
| Condition affecting termination outcome | - When the web app fail to load, show notification. | | |

Table 4. Usecase Add an IP address description

|  |  |  |  |
| --- | --- | --- | --- |
| Usecase name | Add an IP address | | |
| Description | User can add IP address of their call center for the first time | | |
| Actor | User as known as Call center | | |
| Business event | No. | Agent | System response |
|  | 1 | Access the web app. |  |
|  | 2 | Log in the web app. |  |
|  | 3 | Click ‘Configuration’ button on homepage. |  |
|  | 4 |  | Show ‘Configuration’ page. |
|  | 5 | Choose ‘Domain’ tab. |  |
|  | 6 |  | Show IP address input. |
|  | 7 | User inputs a new IP address. |  |
|  | 8 | User clicks ‘Save’ button to save the IP address. |  |
| Preconditions | - User logged in successfully.  - Internet connection required.  - IP address must be a valid one. | | |
| Condition affecting termination outcome | - When the web app fail to load, show notification.  - If the web app fail to save, show notification.  - If the web app save successfully, show notification.  - If the IP address of user is invalid, show notification. | | |

Table 5. Usecase Edit an IP address description

|  |  |  |  |
| --- | --- | --- | --- |
| Usecase name | Edit an IP address | | |
| Description | User can edit IP address of their call center | | |
| Actor | User as known as Call center | | |
| Business event | No. | Agent | System response |
|  | 1 | Access the web app. |  |
|  | 2 | Log in the web app. |  |
|  | 3 | Click ‘Configuration’ button on homepage. |  |
|  | 4 |  | Show ‘Configuration’ page. |
|  | 5 | Choose ‘Domain’ tab. |  |
|  | 6 |  | Show IP address input. |
|  | 7 | User edits the exisitng IP address. |  |
|  | 8 | User clicks ‘Save’ button to save the IP address. |  |
| Preconditions | - User logged in successfully.  - Internet connection required.  - IP address must be a valid one. | | |
| Condition affecting termination outcome | - When the web app fail to load, show notification.  - If the web app fail to save, show notification.  - If the web app save successfully, show notification.  - If the IP address of user is invalid, show notification. | | |

*Table 6. Usecase Manage survey description*

|  |  |  |  |
| --- | --- | --- | --- |
| Usecase name | Manage survey | | |
| Description | User can manage survey of their call center | | |
| Actor | User as known as Call center | | |
| Business event | No. | Agent | System response |
|  | 1 | Access the web app. |  |
|  | 2 | Log in the web app. |  |
|  | 3 | Click ‘Survey Management’ button on homepage. |  |
|  | 4 |  | Show ‘Survey Management’ page. |
| Preconditions | - User logged in successfully.  - Internet connection required. | | |
| Condition affecting termination outcome | - When the web app fail to load, show notification. | | |

Table 7. Usecase Add survey description

|  |  |  |  |
| --- | --- | --- | --- |
| Usecase name | Add survey | | |
| Description | User can add new survey | | |
| Actor | User as known as Call center | | |
| Business event | No. | Agent | System response |
|  | 1 | Access the web app. |  |
|  | 2 | Log in the web app. |  |
|  | 3 | Click ‘Survey Management’ button on homepage. |  |
|  | 4 |  | Show ‘Survey Management’ page. |
|  | 5 | Click ‘Create new’ button. |  |
|  | 6 |  | Show modal for user to input information. |
|  | 7 | User inputs information |  |
|  | 8 | Click ‘save’ button |  |
| Preconditions | - User logged in successfully.  - Internet connection required. | | |
| Condition affecting termination outcome | - When the web app fail to load, show notification.  - When the web app saved successfully, reload and show the latest survey added.  - When the web app fail to save, show notification. | | |

Table 8. Usecase Edit survey description

|  |  |  |  |
| --- | --- | --- | --- |
| Usecase name | Edit survey | | |
| Description | User can edit existing survey | | |
| Actor | User as known as Call center | | |
| Business event | No. | Agent | System response |
|  | 1 | Access the web app. |  |
|  | 2 | Log in the web app. |  |
|  | 3 | Click ‘Survey Management’ button on homepage. |  |
|  | 4 |  | Show ‘Survey Management’ page. |
|  | 5 | Click ‘Edit’ button. |  |
|  | 6 |  | Show modal for user to change information. |
|  | 7 | User changes information. |  |
|  | 8 | Click ‘save’ button. |  |
| Preconditions | - User logged in successfully.  - Internet connection required. | | |
| Condition affecting termination outcome | - When the web app fail to load, show notification.  - When the web app saved successfully, reload and show the latest survey edited.  - When the web app fail to save, show notification. | | |

Table 9. Usecase Delete survey description

|  |  |  |  |
| --- | --- | --- | --- |
| Usecase name | Delete survey | | |
| Description | User can delete existing survey | | |
| Actor | User as known as Call center | | |
| Business event | No. | Agent | System response |
|  | 1 | Access the web app. |  |
|  | 2 | Log in the web app. |  |
|  | 3 | Click ‘Survey Management’ button on homepage. |  |
|  | 4 |  | Show ‘Survey Management’ page. |
|  | 5 | Click ‘Delete’ button. |  |
|  | 6 |  | Show message to ask user if they want to delete or not. |
|  | 7 | Click ‘Yes’ to delete, ‘No’ to cancel delete. |  |
| Preconditions | - User logged in successfully.  - Internet connection required. | | |
| Condition affecting termination outcome | - When the web app fail to load, show notification.  - When the web app deleted successfully, reload the page.  - When the web app fail to delete, show notification. | | |

Table 10. Usecase Manage device description

|  |  |  |  |
| --- | --- | --- | --- |
| Usecase name | Manage device | | |
| Description | User can manage device of their call center | | |
| Actor | User as known as Call center | | |
| Business event | No. | Agent | System response |
|  | 1 | Access the web app. |  |
|  | 2 | Log in the web app. |  |
|  | 3 | Click ‘Configuration’ button on homepage. |  |
|  | 4 |  | Show ‘Configuration’ page. |
|  | 5 | Select ‘Device’ tab. |  |
|  | 6 |  | Show device list. |
| Preconditions | - User logged in successfully.  - Internet connection required. | | |
| Condition affecting termination outcome | - When the web app fail to load, show notification. | | |

Table 11. Usecase Create device description

|  |  |  |  |
| --- | --- | --- | --- |
| Usecase name | Create device | | |
| Description | User can add new device of their call center | | |
| Actor | User as known as Call center | | |
| Business event | No. | Agent | System response |
|  | 1 | Access the web app. |  |
|  | 2 | Log in the web app. |  |
|  | 3 | Click ‘Configuration’ button on homepage. |  |
|  | 4 |  | Show ‘Configuration’ page. |
|  | 5 | Select ‘Device’ tab. |  |
|  | 6 |  | Show device list. |
|  | 7 | Click ‘Create new’ button. |  |
|  | 8 |  | Show modal for user to input information. |
|  | 9 | User inputs information for device. |  |
|  | 10 | Click ‘Save’ button. |  |
| Preconditions | - User logged in successfully.  - Internet connection required. | | |
| Condition affecting termination outcome | - When the web app fail to load, show notification.  - When the web app saved successfully, reload and show the latest device added.  - When the web app fail to save, show notification. | | |

Table 12. Usecase Edit device description

|  |  |  |  |
| --- | --- | --- | --- |
| Usecase name | Edit device | | |
| Description | User can edit existing device of their call center | | |
| Actor | User as known as Call center | | |
| Business event | No. | Agent | System response |
|  | 1 | Access the web app. |  |
|  | 2 | Log in the web app. |  |
|  | 3 | Click ‘Configuration’ button on homepage. |  |
|  | 4 |  | Show ‘Configuration’ page. |
|  | 5 | Select ‘Device’ tab. |  |
|  | 6 |  | Show device list. |
|  | 7 | Click edit button. |  |
|  | 8 |  | Show modal for user to edit information. |
|  | 9 | User edit information for device if needed |  |
|  | 10 | Click ‘Save’ button. |  |
| Preconditions | - User logged in successfully.  - Internet connection required. | | |
| Condition affecting termination outcome | - When the web app fail to load, show notification.  - When the web app saved successfully, reload and show the latest device edited.  - When the web app fail to save, show notification. | | |

Table 13. Usecase Delete device description

|  |  |  |  |
| --- | --- | --- | --- |
| Usecase name | Delete device | | |
| Description | User can delete existing device of their call center | | |
| Actor | User as known as Call center | | |
| Business event | No. | Agent | System response |
|  | 1 | Access the web app. |  |
|  | 2 | Log in the web app. |  |
|  | 3 | Click ‘Configuration’ button on homepage. |  |
|  | 4 |  | Show ‘Configuration’ page. |
|  | 5 | Select ‘Device’ tab. |  |
|  | 6 |  | Show device list. |
|  | 7 | Click delete button. |  |
|  | 8 |  | Show message to ask user if they want to delete or not. |
|  | 9 | Click ‘Yes’ to delete, ‘No’ to cancel delete. |  |
| Preconditions | - User logged in successfully.  - Internet connection required. | | |
| Condition affecting termination outcome | - When the web app fail to load, show notification.  - When the web app deleted successfully, reload the page.  - When the web app fail to delete, show notification. | | |

Table 14. Usecase Manage agent description

|  |  |  |  |
| --- | --- | --- | --- |
| Usecase name | Manage agent | | |
| Description | User can manage agent of their call center | | |
| Actor | User as known as Call center | | |
| Business event | No. | Agent | System response |
|  | 1 | Access the web app. |  |
|  | 2 | Log in the web app. |  |
|  | 3 | Click ‘Configuration’ button on homepage. |  |
|  | 4 |  | Show ‘Configuration’ page. |
|  | 5 | Select ‘Agent’ tab. |  |
|  | 6 |  | Show agent list. |
| Preconditions | - User logged in successfully.  - Internet connection required. | | |
| Condition affecting termination outcome | - When the web app fail to load, show notification. | | |

Table 15. Usecase Create agent description

|  |  |  |  |
| --- | --- | --- | --- |
| Usecase name | Create agent | | |
| Description | User can add new agent of their call center | | |
| Actor | User as known as Call center | | |
| Business event | No. | Agent | System response |
|  | 1 | Access the web app. |  |
|  | 2 | Log in the web app. |  |
|  | 3 | Click ‘Configuration’ button on homepage. |  |
|  | 4 |  | Show ‘Configuration’ page. |
|  | 5 | Select ‘Agent’ tab. |  |
|  | 6 |  | Show agent list. |
|  | 7 | Click ‘Create new’ button. |  |
|  | 8 |  | Show modal for user to input information. |
|  | 9 | User inputs information for agent. |  |
|  | 10 | Click ‘Save’ button. |  |
| Preconditions | - User logged in successfully.  - Internet connection required. | | |
| Condition affecting termination outcome | - When the web app fail to load, show notification.  - When the web app saved successfully, reload and show the latest agent added.  - When the web app fail to save, show notification. | | |

Table 16. Usecase Edit agent description

|  |  |  |  |
| --- | --- | --- | --- |
| Usecase name | Edit agent | | |
| Description | User can edit existing agent of their call center | | |
| Actor | User as known as Call center | | |
| Business event | No. | Agent | System response |
|  | 1 | Access the web app. |  |
|  | 2 | Log in the web app. |  |
|  | 3 | Click ‘Configuration’ button on homepage. |  |
|  | 4 |  | Show ‘Configuration’ page. |
|  | 5 | Select ‘Agent’ tab. |  |
|  | 6 |  | Show agent list. |
|  | 7 | Click edit button. |  |
|  | 8 |  | Show modal for user to edit information. |
|  | 9 | User edit information for agent if needed |  |
|  | 10 | Click ‘Save’ button. |  |
| Preconditions | - User logged in successfully.  - Internet connection required. | | |
| Condition affecting termination outcome | - When the web app fail to load, show notification.  - When the web app saved successfully, reload and show the latest agent edited.  - When the web app fail to save, show notification. | | |

Table 17. Usecase Delete agent description

|  |  |  |  |
| --- | --- | --- | --- |
| Usecase name | Delete agent | | |
| Description | User can delete existing agent of their call center | | |
| Actor | User as known as Call center | | |
| Business event | No. | Agent | System response |
|  | 1 | Access the web app. |  |
|  | 2 | Log in the web app. |  |
|  | 3 | Click ‘Configuration’ button on homepage. |  |
|  | 4 |  | Show ‘Configuration’ page. |
|  | 5 | Select ‘Agent’ tab. |  |
|  | 6 |  | Show agent list. |
|  | 7 | Click delete button. |  |
|  | 8 |  | Show message to ask user if they want to delete or not. |
|  | 9 | Click ‘Yes’ to delete, ‘No’ to cancel delete. |  |
| Preconditions | - User logged in successfully.  - Internet connection required. | | |
| Condition affecting termination outcome | - When the web app fail to load, show notification.  - When the web app deleted successfully, reload the page.  - When the web app fail to delete, show notification. | | |

Table 18. Usecase View reports description

|  |  |  |  |
| --- | --- | --- | --- |
| Usecase name | View reports | | |
| Description | User view reports about their call center agents | | |
| Actor | User as known as Call center | | |
| Business event | No. | Agent | System response |
|  | 1 | Click ‘Report’ button. |  |
|  | 2 |  | Show ‘Report’ page. |
|  | 3 | User inputs conditions of report |  |
|  | 4 | Click ‘View report’ button |  |
|  | 5 |  | Show report bases on user’s conditions. |
| Preconditions | - User logged in successfully.  - Internet connection required. | | |
| Condition affecting termination outcome | When the web app fail to load, show notification. | | |

Table 19. Usecase Logout description

|  |  |  |  |
| --- | --- | --- | --- |
| Usecase name | Logout | | |
| Description | User can logout of the web app | | |
| Actor | User as known as Call center | | |
| Business event | No. | Agent | System response |
|  | 1 | Click ‘Sign out’ button. |  |
|  | 2 |  | Disconnect user’s account from the web app. |
|  | 3 |  | Redirect to main interface of the web app. |
|  | 4 |  | Show ‘Configuration’ page. |
| Preconditions | - User logged in successfully.  - Internet connection required. | | |
| Condition affecting termination outcome | When the web app fail to load, show notification. | | |

Table 20. Usecase Take survey description

|  |  |  |  |
| --- | --- | --- | --- |
| Usecase name | Take survey | | |
| Description | User can logout of the web app | | |
| Actor | Call center’s customer | | |
| Business event | No. | Agent | System response |
|  | 1 | Answer the call. |  |
|  | 2 |  | Play IVR to ask customer if they want to do survey or not. |
|  | 3 | Customer can agree to do survey or not. If they agree, press 1 otherwise press 2 to cancel. |  |
|  | 4 |  | Play IVR survey of the call center and guide customer to do survey. |
|  | 5 | Customer press desired number on the phone to rate the agent |  |
| Preconditions | an make a call to the customer | | |
| Condition affecting termination outcome | If customer pressed other keys instead of number keys, inform them that they have pressed invalid keys. | | |

**2. System design**

## **2.1. Technology**

With this project, we are going to use 2 main technologies are Asterisk and ASP.NET Core to build the Cloud Survey App.

**2.1.1. Asterisk**

**-** To create the IVR survey for whichever call center wants to use the survey service, we are using the Asterisk to support them because Asterisk provides us with everything we need for the business telephone system, especially the IVR. Besides that, Asterisk is the basis of every contact system.

- Asterisk is an open source framework for building communications applications. Asterisk turns an ordinary computer into a communication server. Asterisk powers IP PBX systems, VoIP gateways, conference servers and other custom solutions. It is used by small businesses, large businesses, call centers, carriers and government agencies, worldwide. Asterisk is free and open source. Asterisk is sponsored by Digium. [1]



Image 2. Asterisk logo

- Asterisk is:

+ Written in C programming language.

+ Primarily running on Linux operating system.

+ Powering Business Telephone Systems.

+ Connecting many different Telephony protocols.

+ A toolkit for building many things:

* An IP PBX with many powerful features and applications.
* VoIP gateways.
* Conferencing system

+ Supporting VoIP phones as well as PSTN and POTS.

+ Speaking SIP, the most common VoIP protocol, among others. [2]

**2.1.2. ASP.NET Core**

**2.1.2.1. About .NET Core**

.NET Core is an open-source, general-purpose development platform maintained by Microsoft and the .NET community on GitHub. It's cross-platform (supporting Windows, macOS, and Linux) and can be used to build device, cloud, and IoT applications.



Image 3. ASP.NET Core

**2.1.2.2. Characteristics of .Net Core**

**- Cross-platform**: Runs on Windows, macOS and Linux operating systems.

**- Consistent across architectures**: Runs your code with the same behavior on multiple architectures, including x64, x86, and ARM.

**- Command-line tools**: Includes easy-to-use command-line tools that can be used for local development and in continuous-integration scenarios.

**- Flexible deployment**: Can be included in your app or installed side-by-side (user-wide or system-wide installations). Can be used with Docker containers.

**- Compatible**: .NET Core is compatible with .NET Framework, Xamarin and Mono, via .NET Standard.

**- Open source**: The .NET Core platform is open source, using MIT and Apache 2 licenses. .NET Core is a .NET Foundation project.

**- Supported by Microsoft**: .NET Core is supported by Microsoft, per .NET Core Support.

## **2.2. Architecture design**

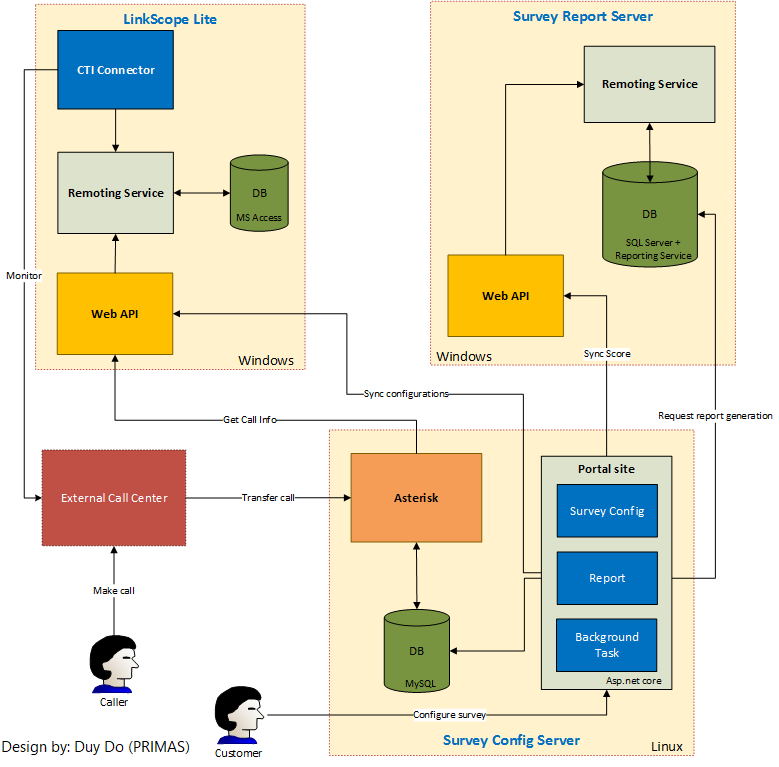


Image 4. Architecture design

**Survey Config Server**

- The heart of this project lies inside the ‘Survey Config Server’ component. This is the basis of the system and this is where we are primarily working with.

- **Asterisk:** Asterisk will be installed on Linux server, this is where **external call center** transfers their customer’s call to and gets the IVR survey played in order to get customer’s feedback. It also calls web API from ‘LinkScope Lite’ component to get call info and interact with data from MySQL database.

- **Portal site:** This is the main web app for user to register and use our services. It’s where user gets started and configures their surveys, user can also view report on this site. Besides that, portal side also has some background tasks such as: sync configurations to the LinkScope Lite, request report generation from SSRS of Survey Report Server component and interact with data from MySQL server.

- **MySQL database:** Store data comes from both Asterisk and Portal site, it also provides data for them.

**LinkScope Lite**

- Besides the main component, LinkScope Lite component supports the main component to run properly.

- Web API: This is where the main component request to do actions such as: get call info and synchronize configurations. The web API also communicate with Remoting Service to interact with data from database.

- **CTI Connector:**

- **Remoting Service:** Get data from database for CTI Connector and Web API to access, it also adds call info to database.

- **Microsoft Access database:** store configurations come from main components. MS Access is used because its simplicity and to avoid installing MySQL or SQL Server on client’s computer which might be too complex.

**Survey Report Server**

- Survey Report Server component also supports the main component to run properly.

- **Web API:** This is there the main component request to do action such as: synchronize survey score. The web API also communicate with Remoting Service to interact with data from database.

- **Remoting service:** Get data from database for web API to access.

- **SQL Server Reporting Service database:** allow the portal site to make request for report generation, store report information.

## **2.3. Design user interface**

In software programming, user interfaces have a really big role to determine if a project is worth using. No matter how perfect the back-end programming is, if the UI doesn’t look good, user will not like it. So technically, a good looking UI will bring to users a better experience while using application.

Table 21. UI work assignment

|  |  |  |  |
| --- | --- | --- | --- |
| No | Interface | Designer | Purpose |
| 1 | Homepage | Nguyen Mai Hung | In this page, a guest can click sign in or sign up to access to the web app. |
| 2 | Login page | Nguyen Mai Hung | In this page, a guest can input email and password to log in. Beside that, s/he can recover password if forgot or can register a new account. |
| 3 | Forgot password page | Nguyen Mai Hung | Guest can recover password if forgot. |
| 4 | Register page | Nguyen Mai Hung | Guest can register a new account |
| 5 | Main page | Nguyen Mai Hung | After login successfully, user can choose tabs to do their work such as Configuration, Survey Management, Report. User can also logout here. |
| 6 | Configuration page | Nguyen Mai Hung | In this page, user can work with configuration of domain, device and agent. |
| 7 | Domain configuration | Tran Tan Quy | User can add/edit IP address of their call center. |
| 8 | Device configuration | Tran Tan Quy | User can manage, search and filter devices of their call center. |
| 9 | Add device | Tran Tan Quy | User can add a new device |
| 10 | Edit device | Tran Tan Quy | User can edit an existing device. |
| 11 | Agent configuration | Nguyen Mai Hung | User can manage, search and filter agents of their call center. |
| 12 | Add agent | Nguyen Mai Hung | User can add a new agent. |
| 13 | Edit agent | Nguyen Mai Hung | User can edit an existing agent. |
| 14 | Survey management page | Nguyen Mai Hung | User can manage survey and view report of the survey. |
| 15 | Add survey | Nguyen Mai Hung | User can add a new survey. |
| 16 | Edit survey | Nguyen Mai Hung | User can edit an existing survey. |
| 17 | Report page | Nguyen Mai Hung | User can view reports of their call center. |

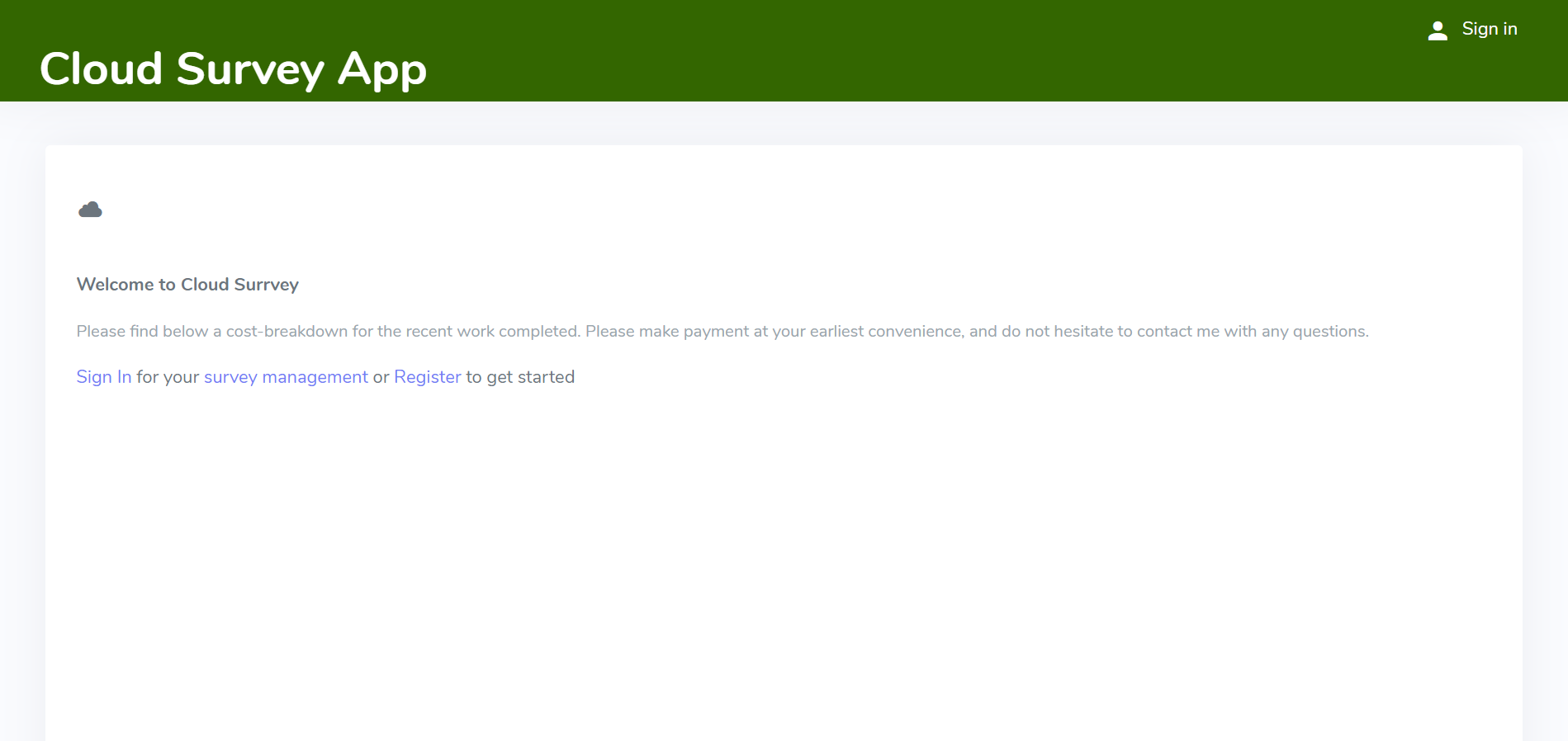


Image 5. Homepage

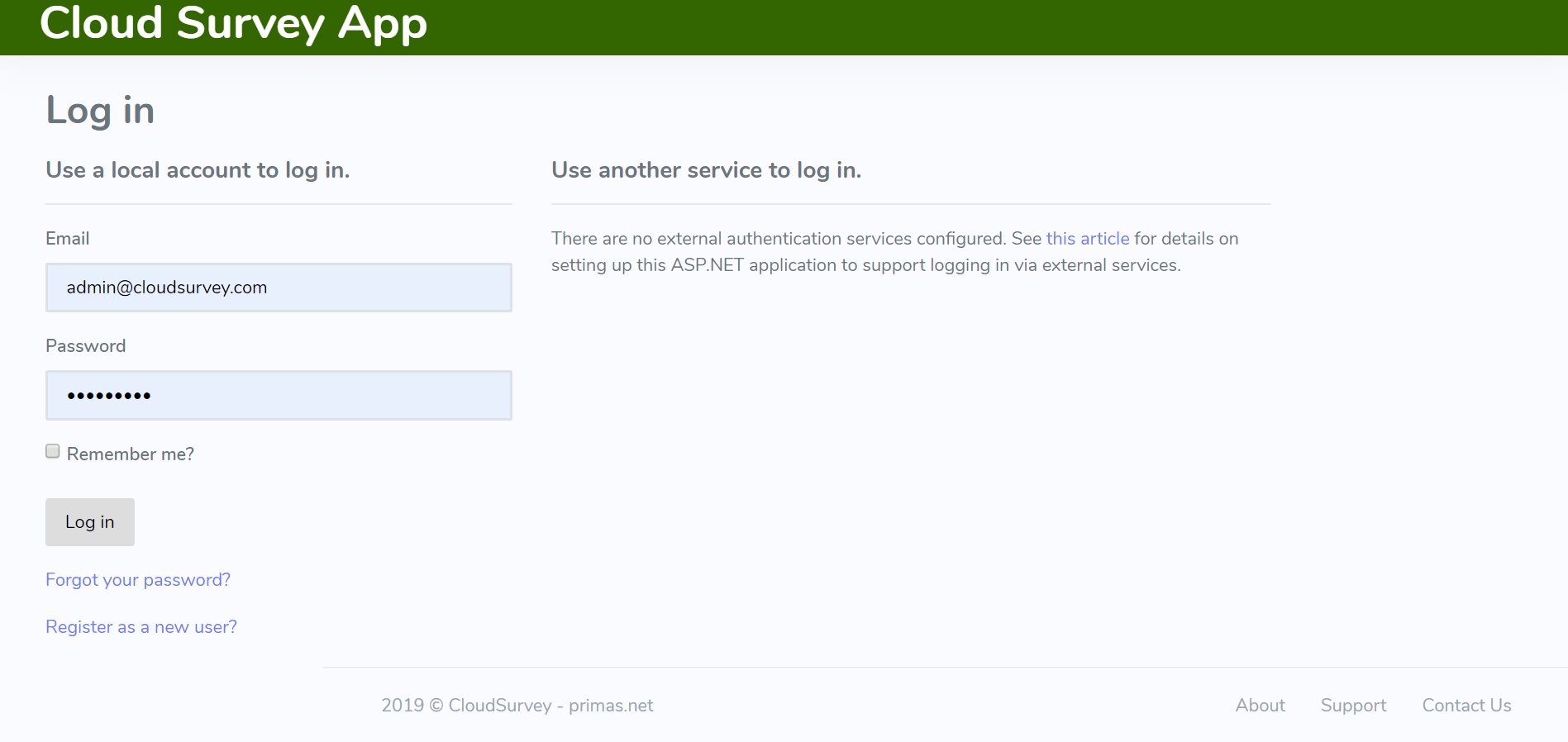


Image 6. Login page

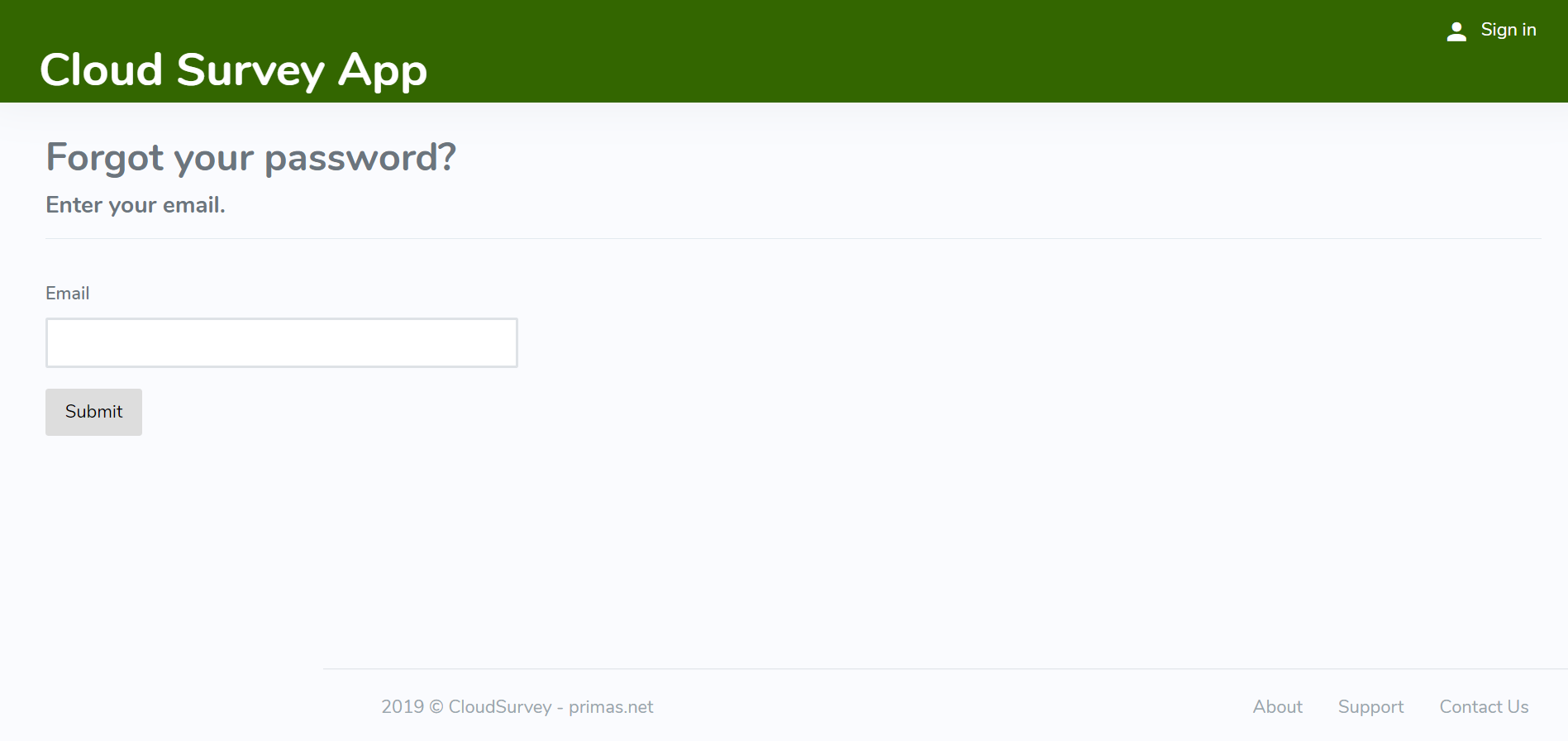


Image 7. Forgot password page

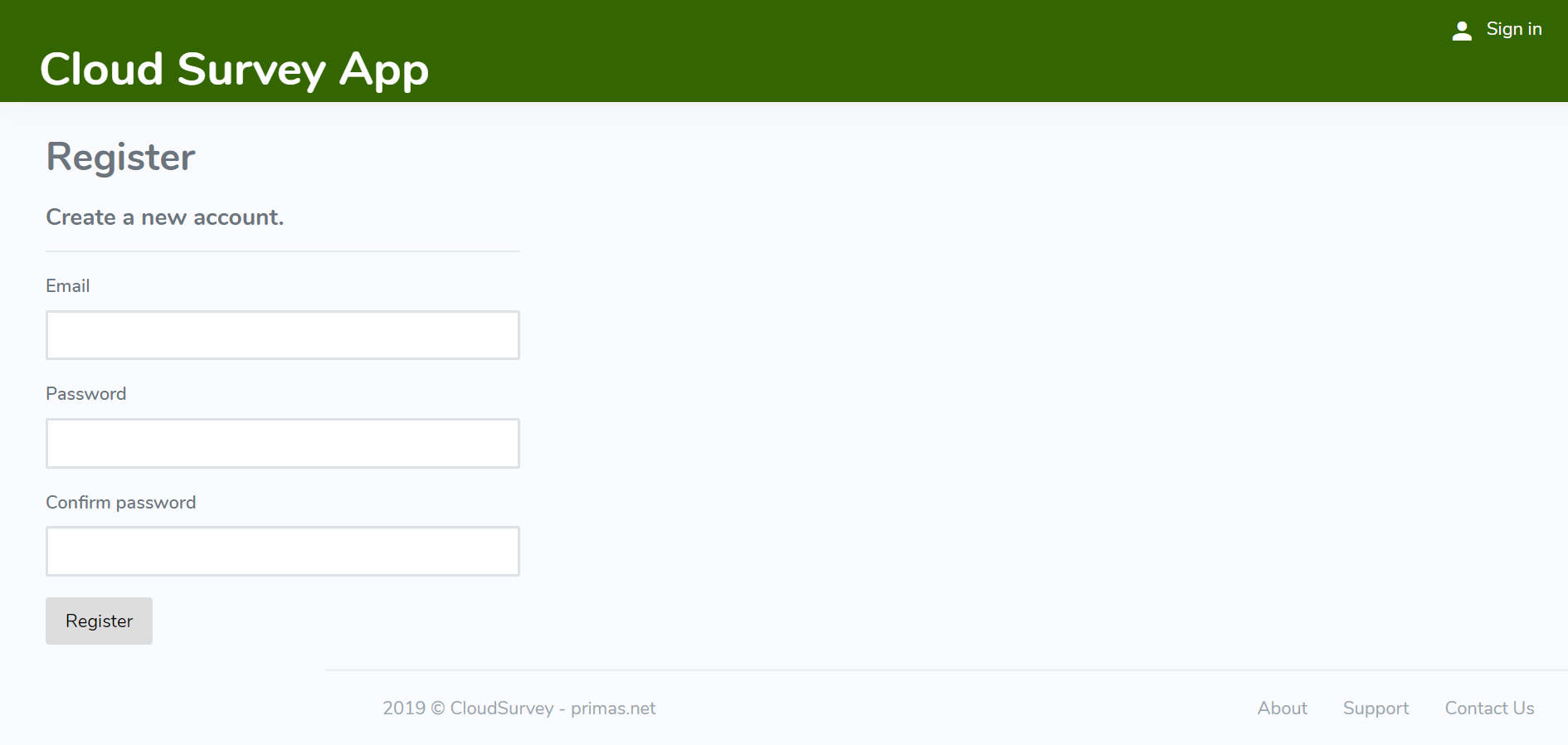


Image 8. Register page

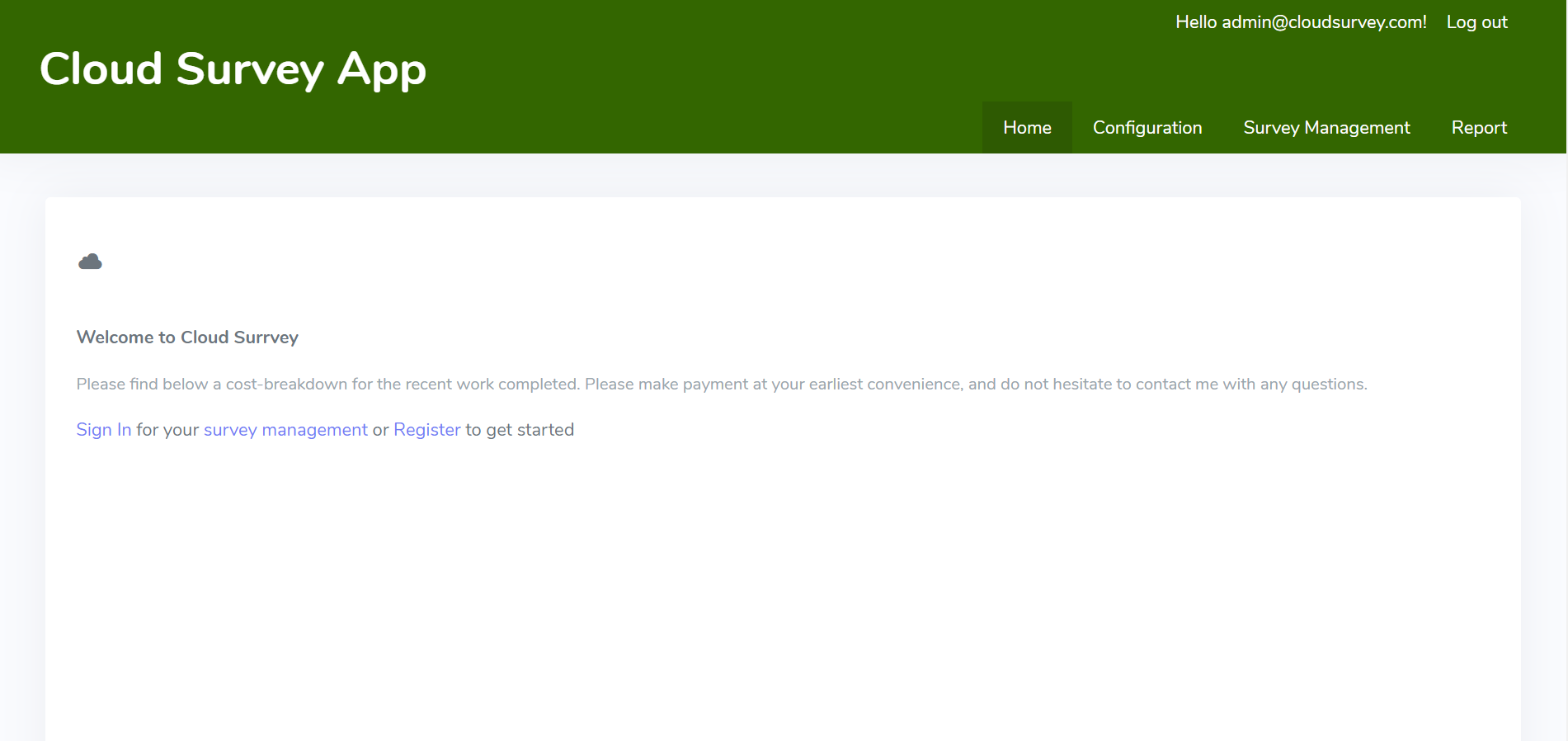


Image 9. Main page

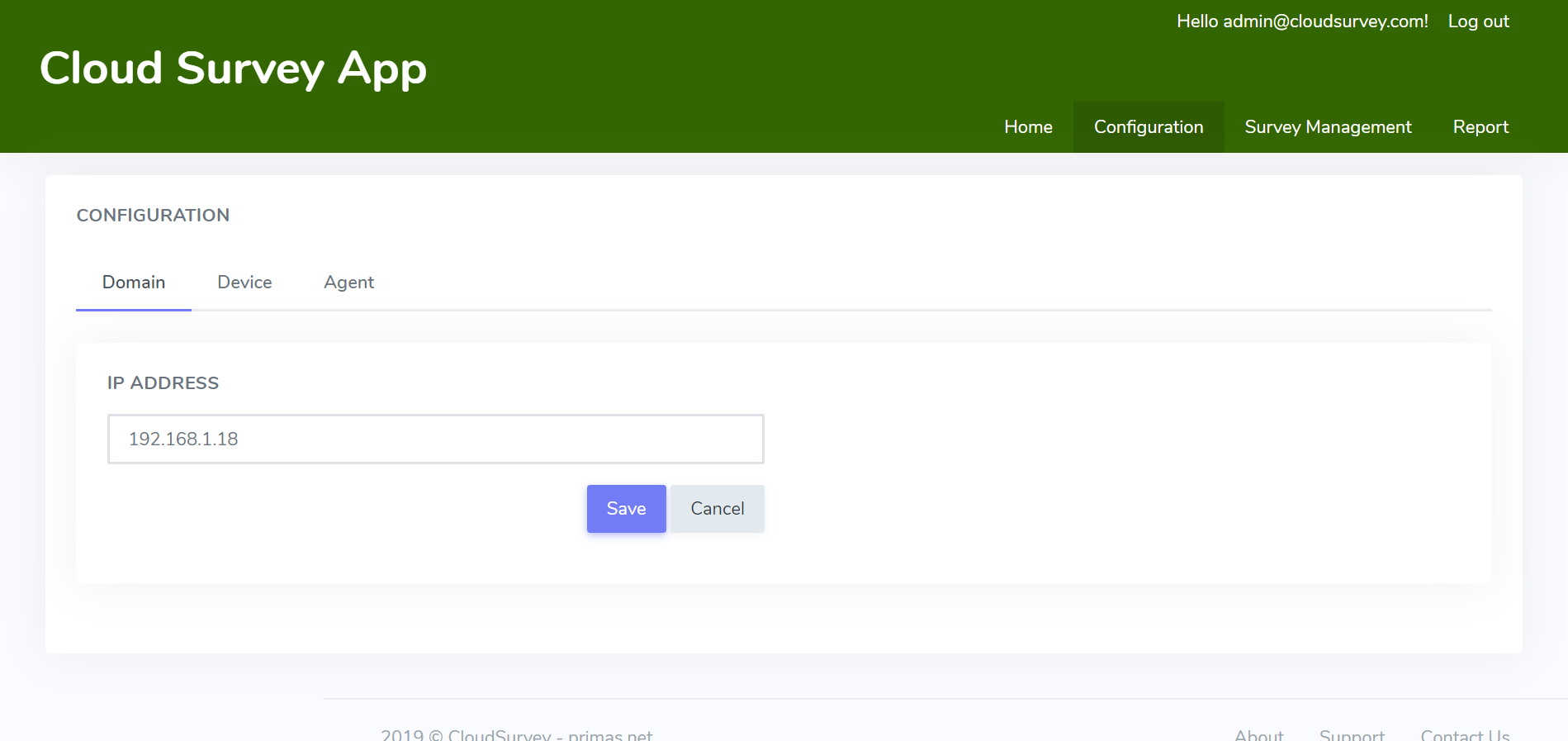


Image 10. Configuration page & Image 11. Domain configuration

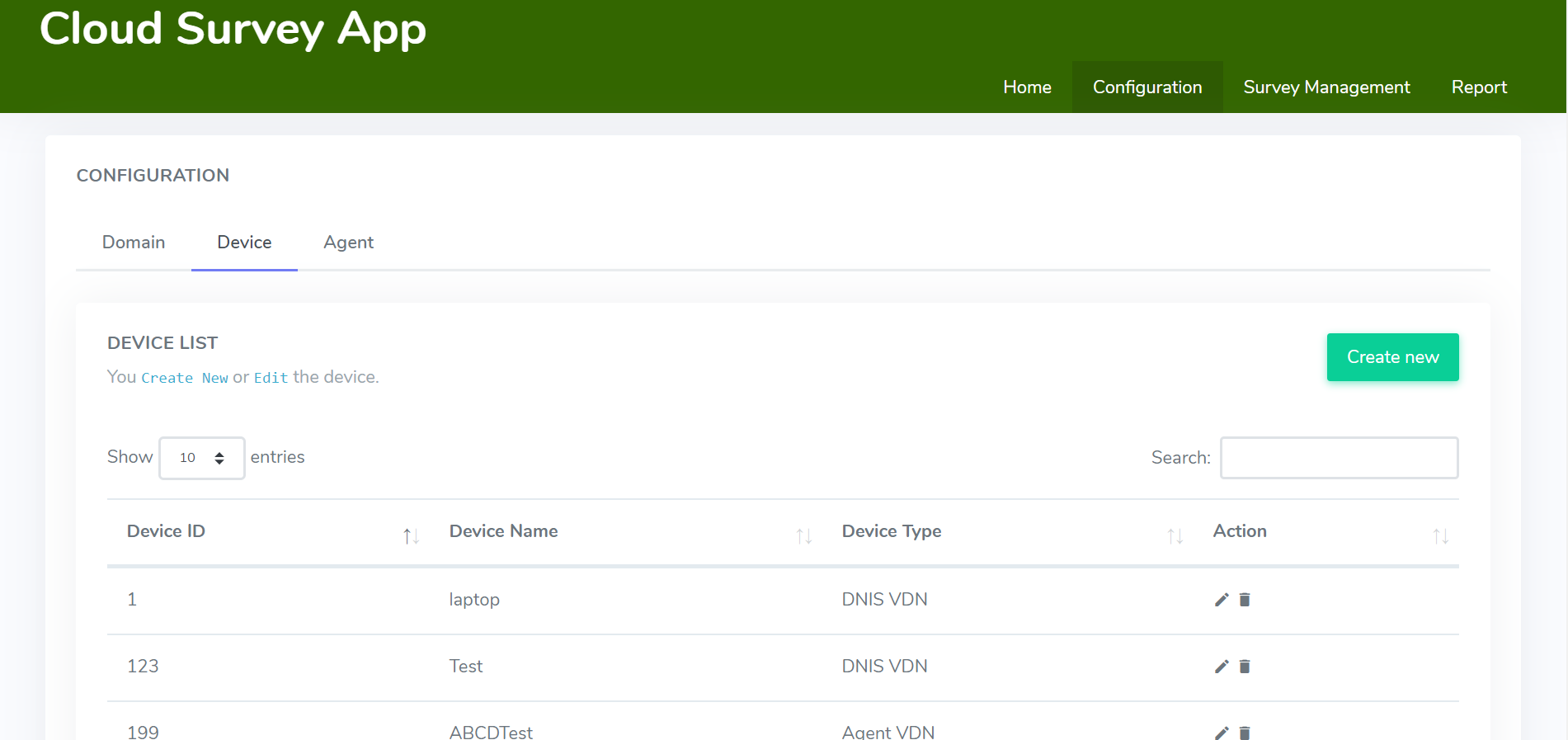


Image 12. Device configuration

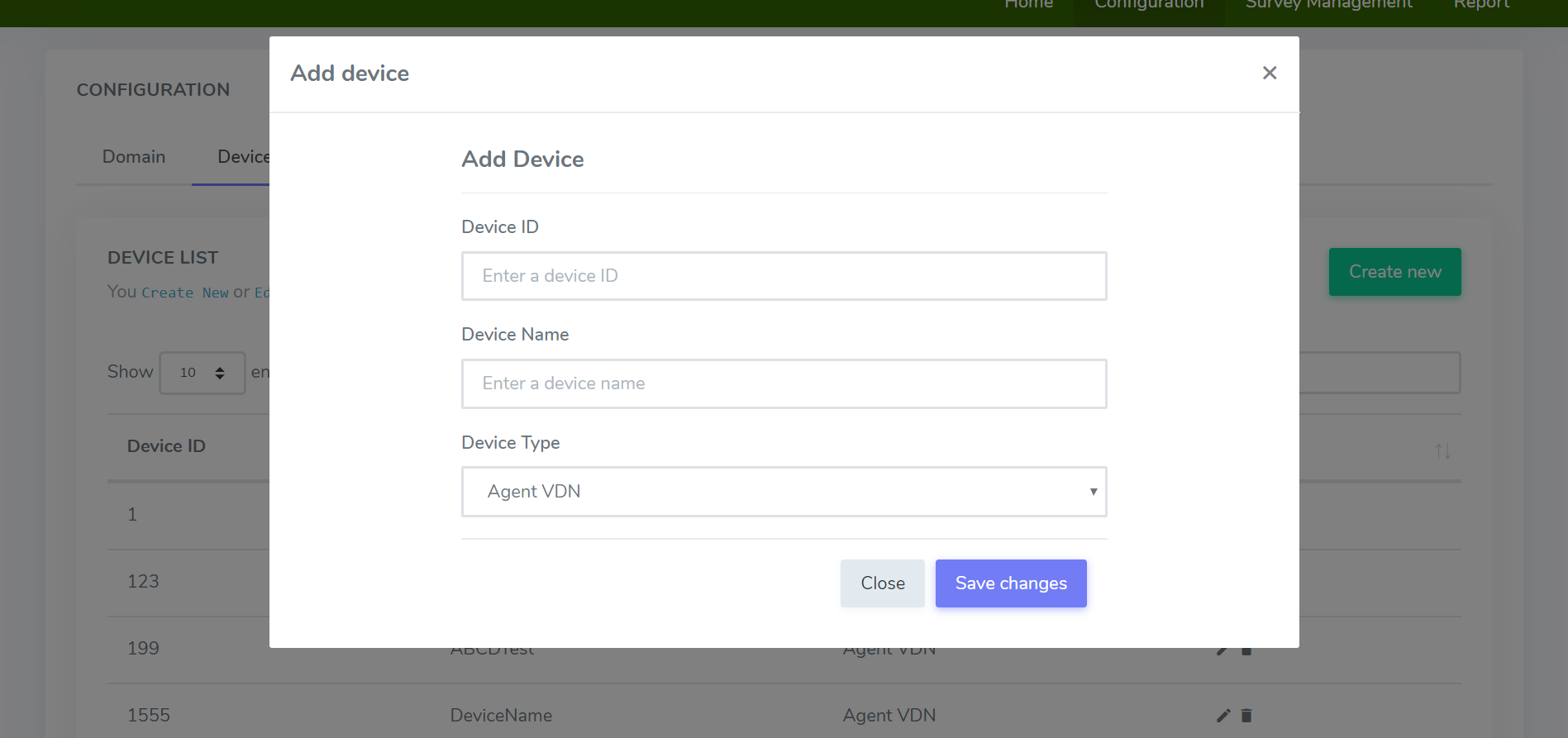


Image 13. Add device

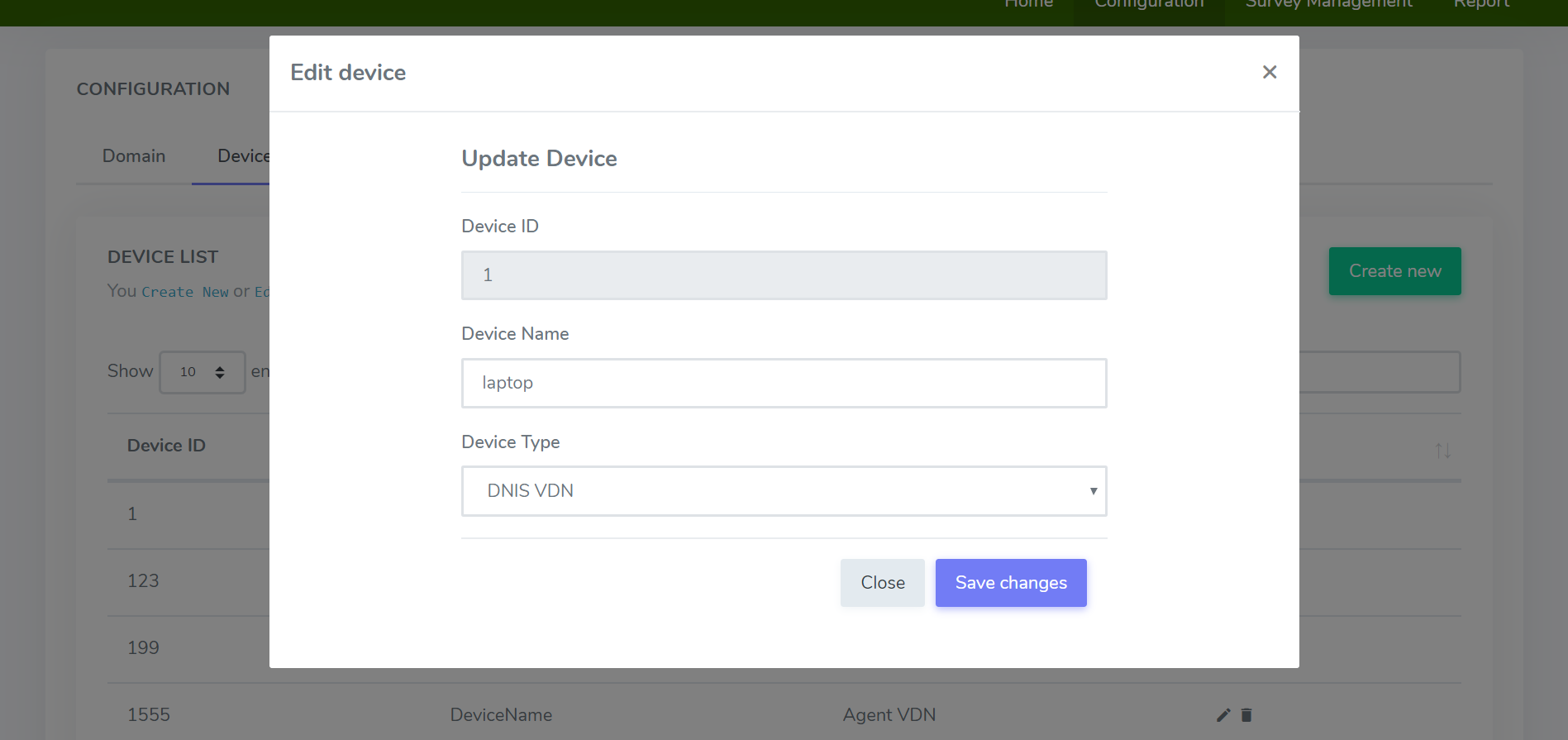


Image 14. Edit device

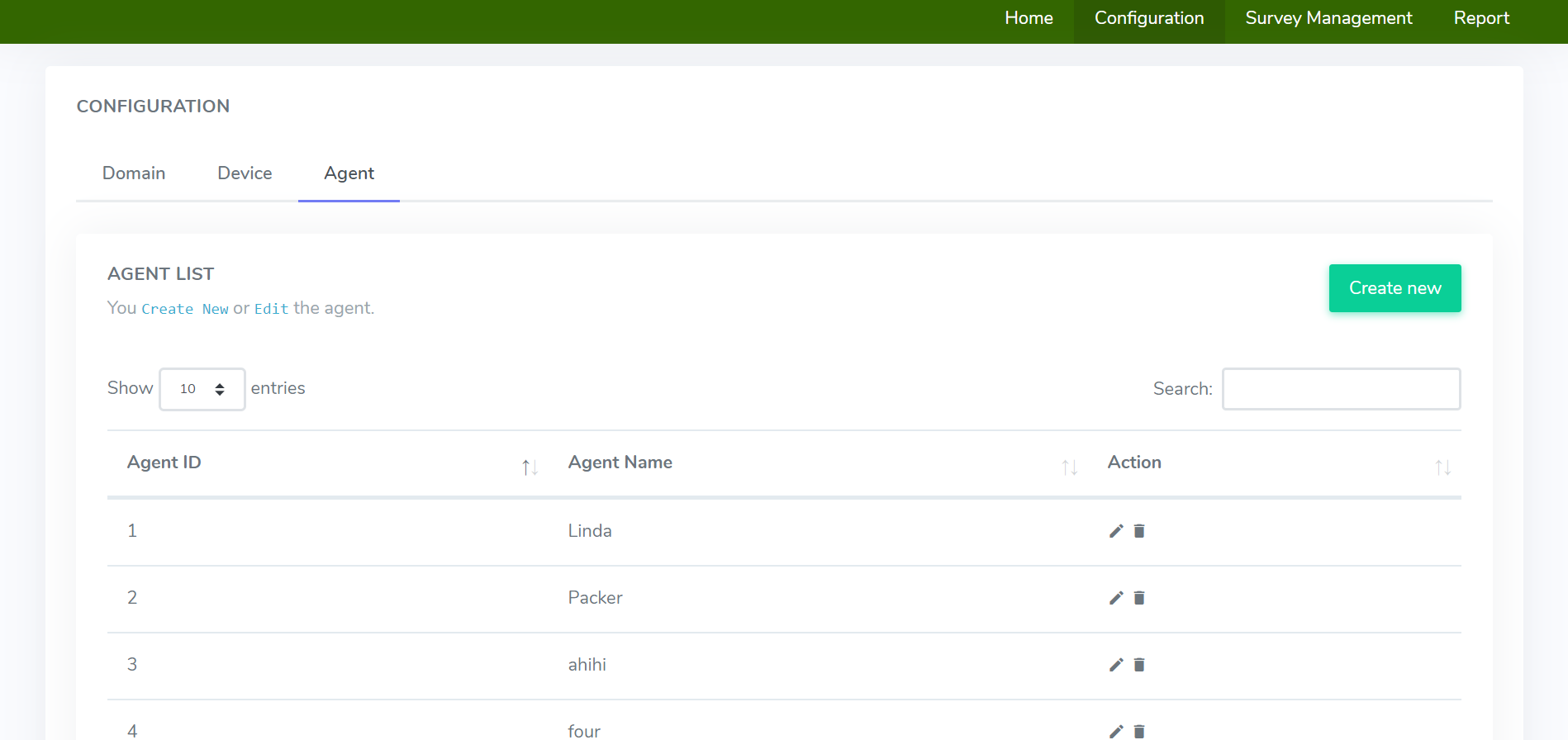


Image 15. Agent configuration

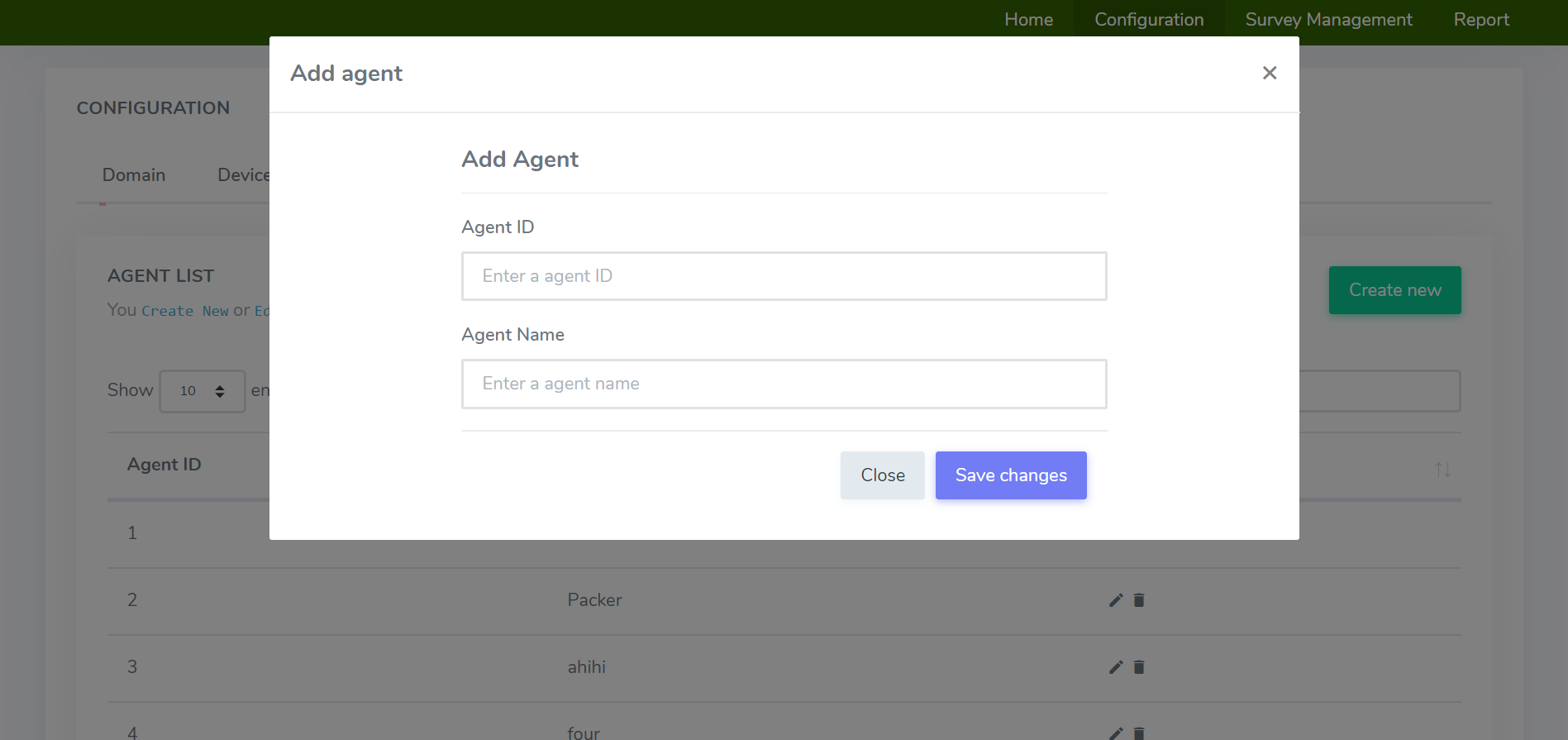


Image 16. Add agent

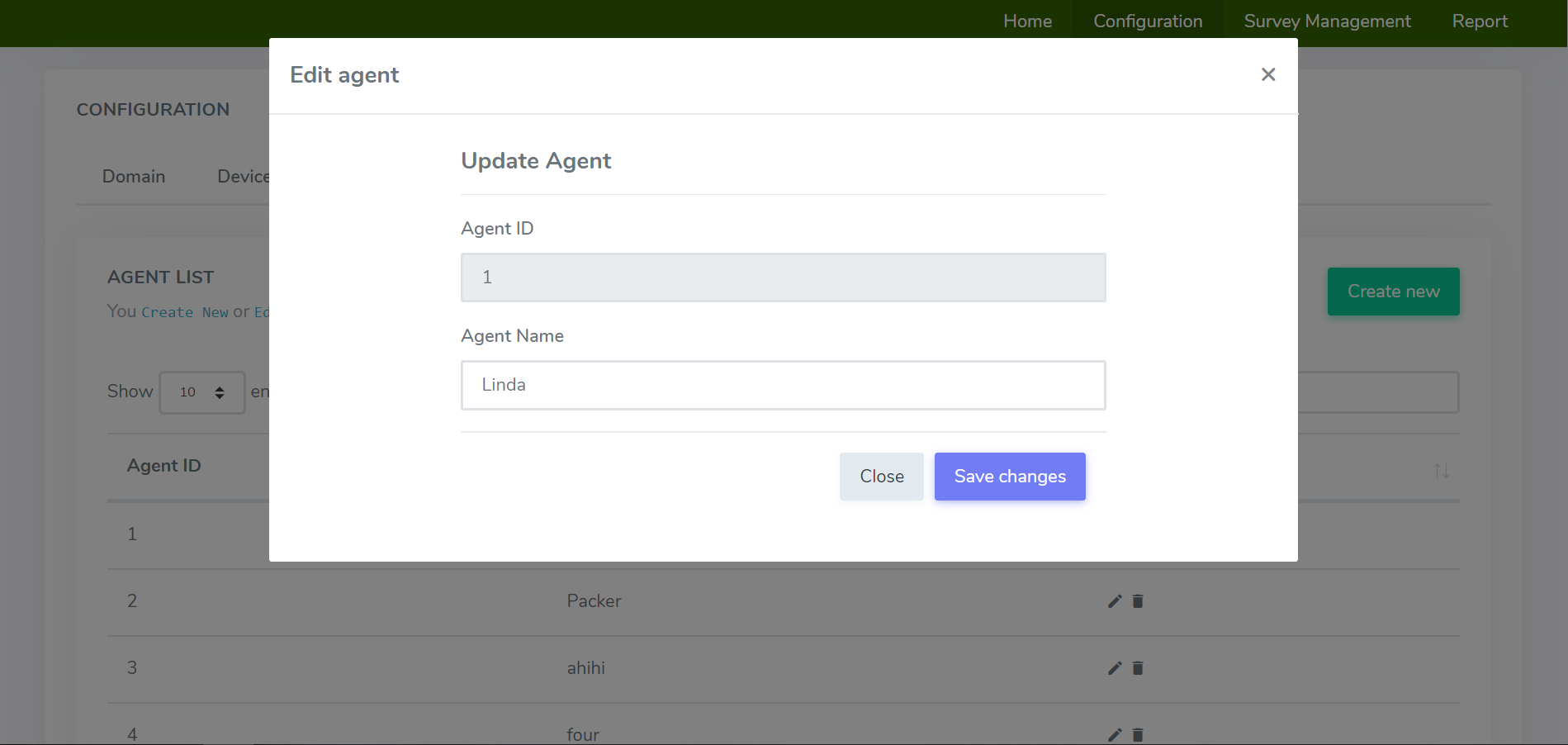


Image 17. Edit agent

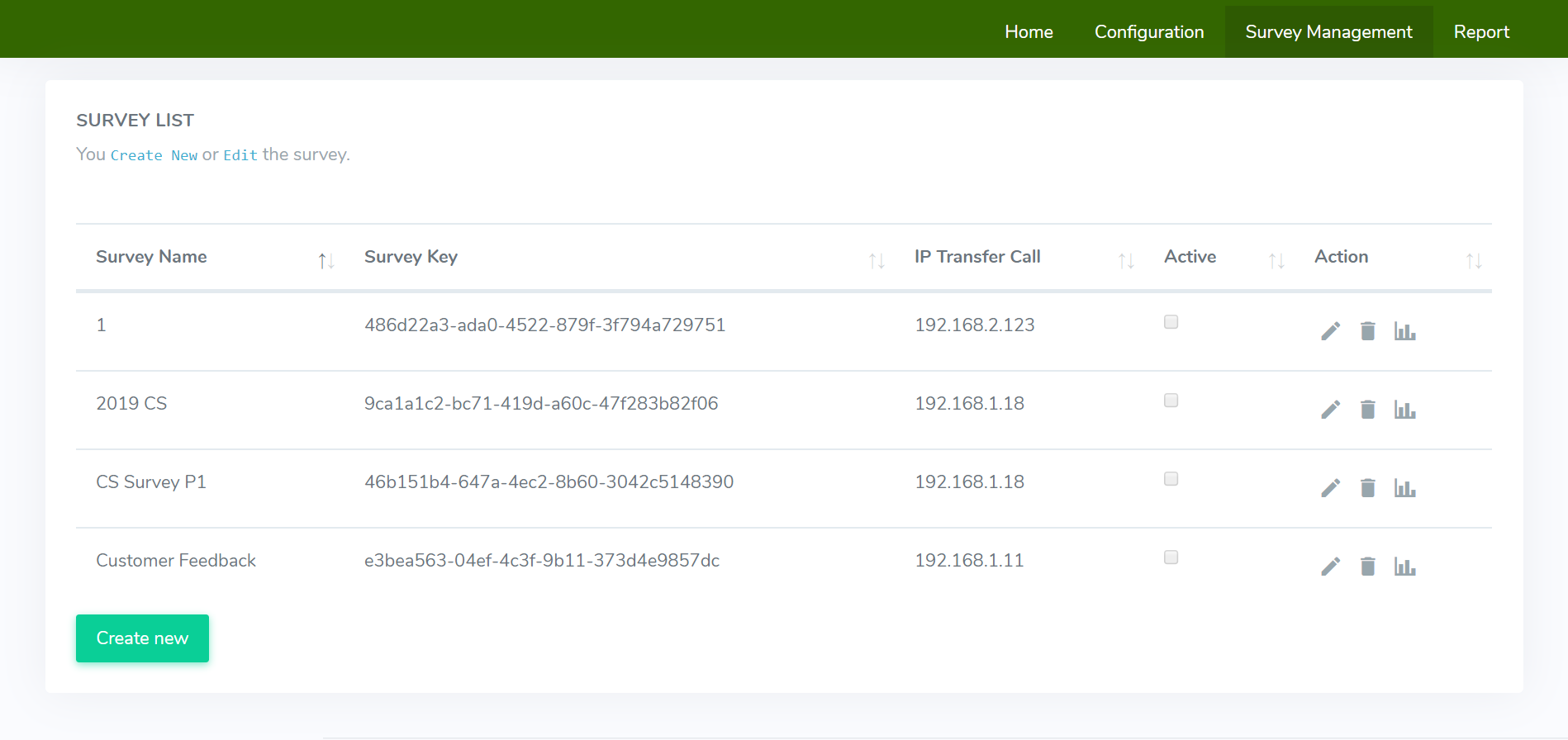


Image 18. Survey management page

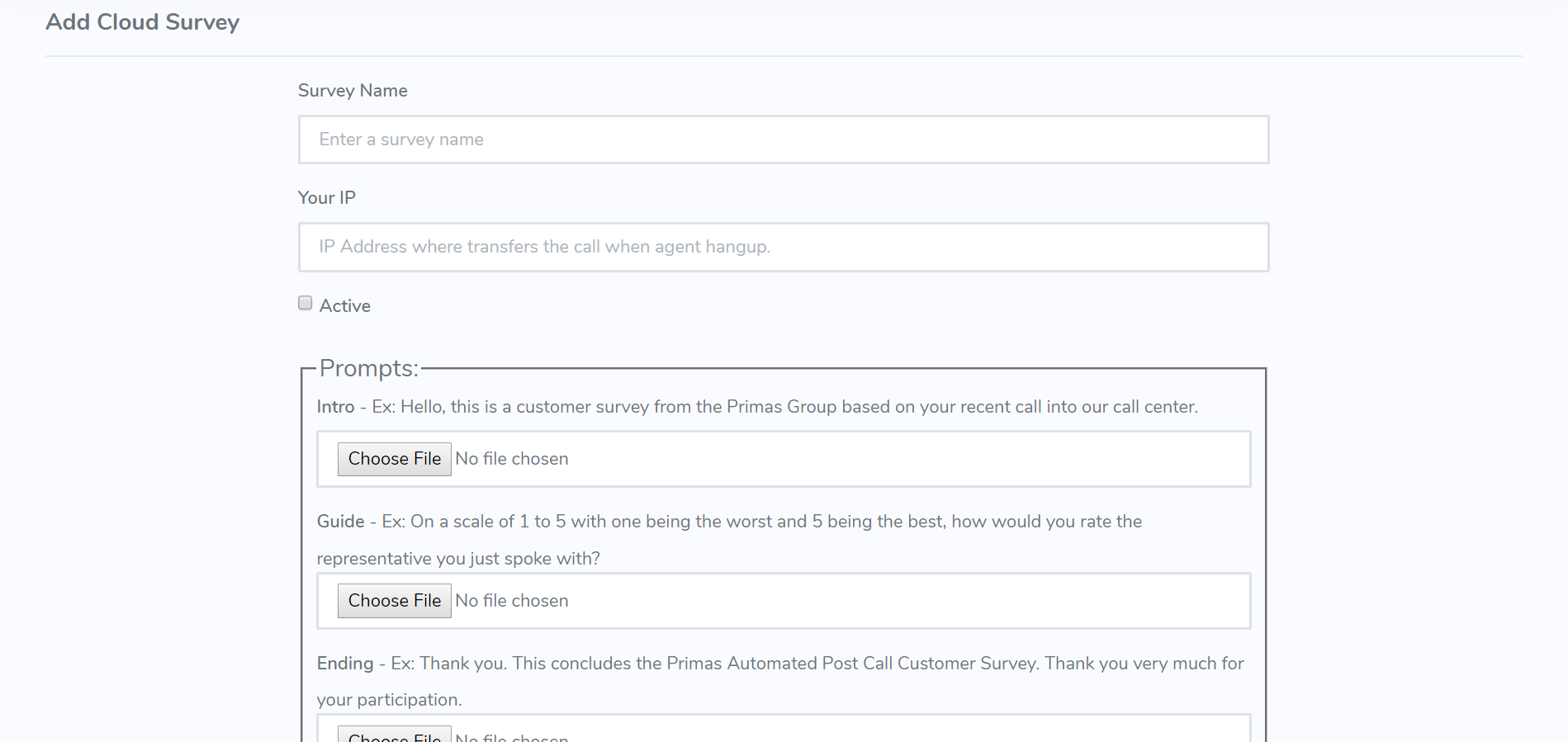


Image 19. Add survey

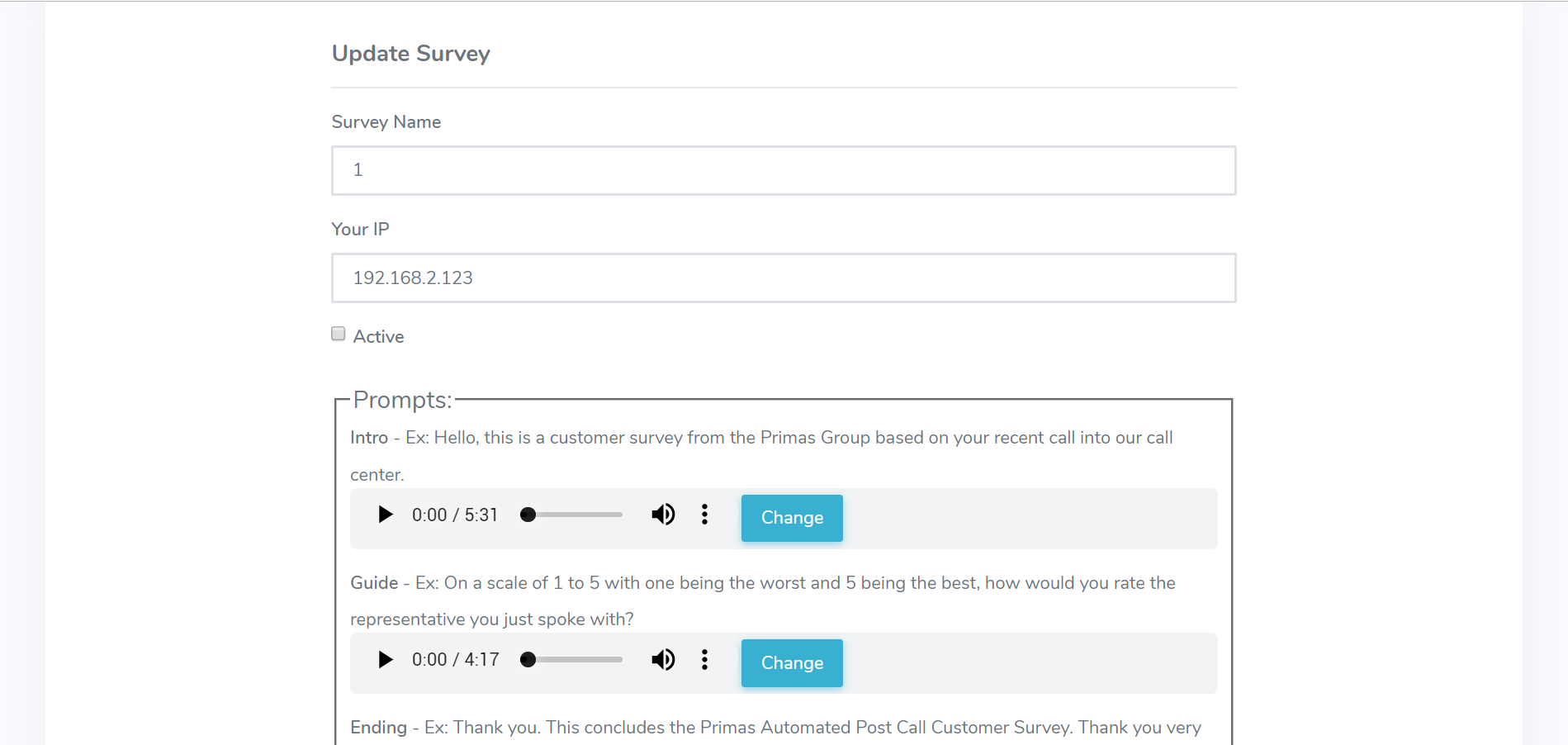


Image 20. Edit survey

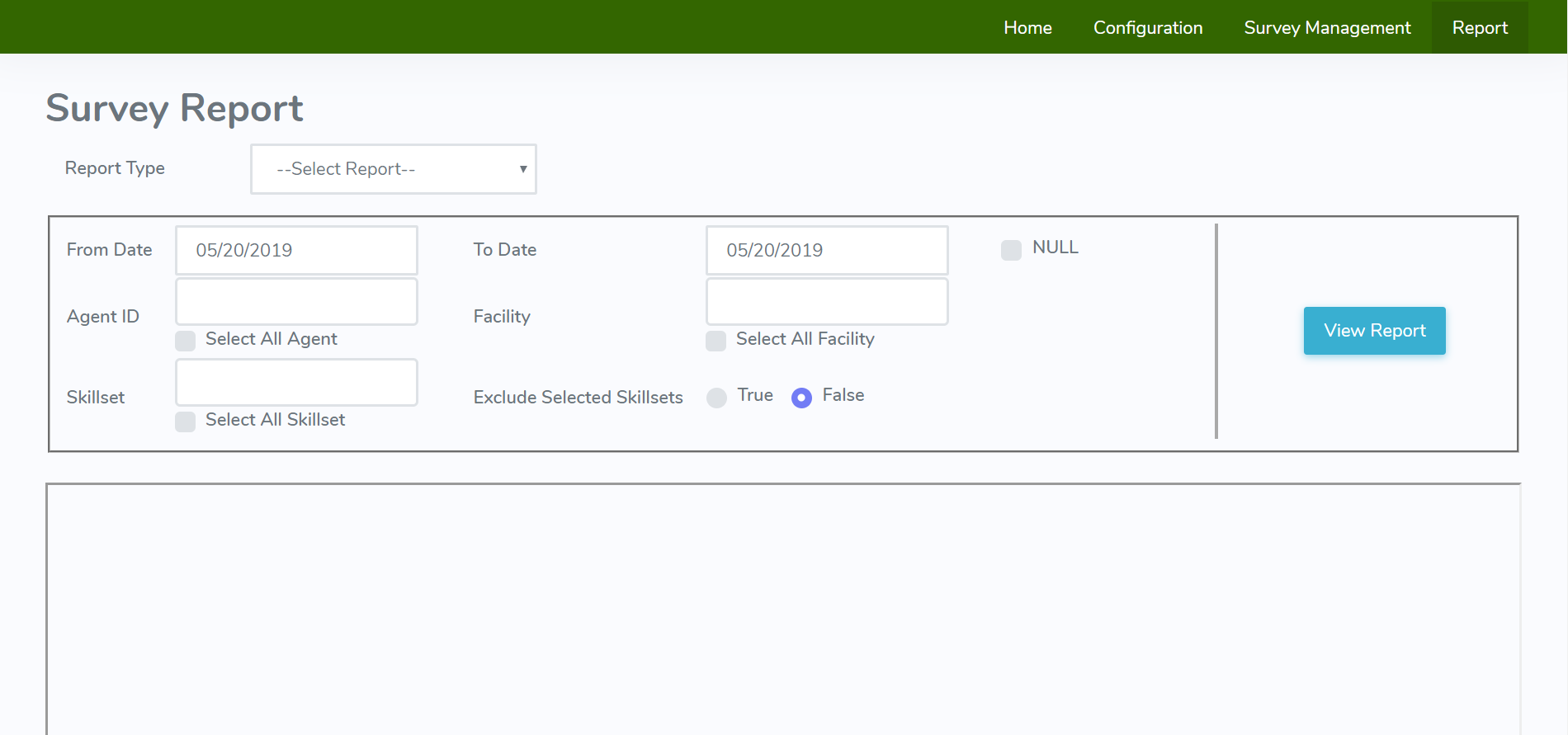


Image 21. Report page

## **2.4. Class diagram**

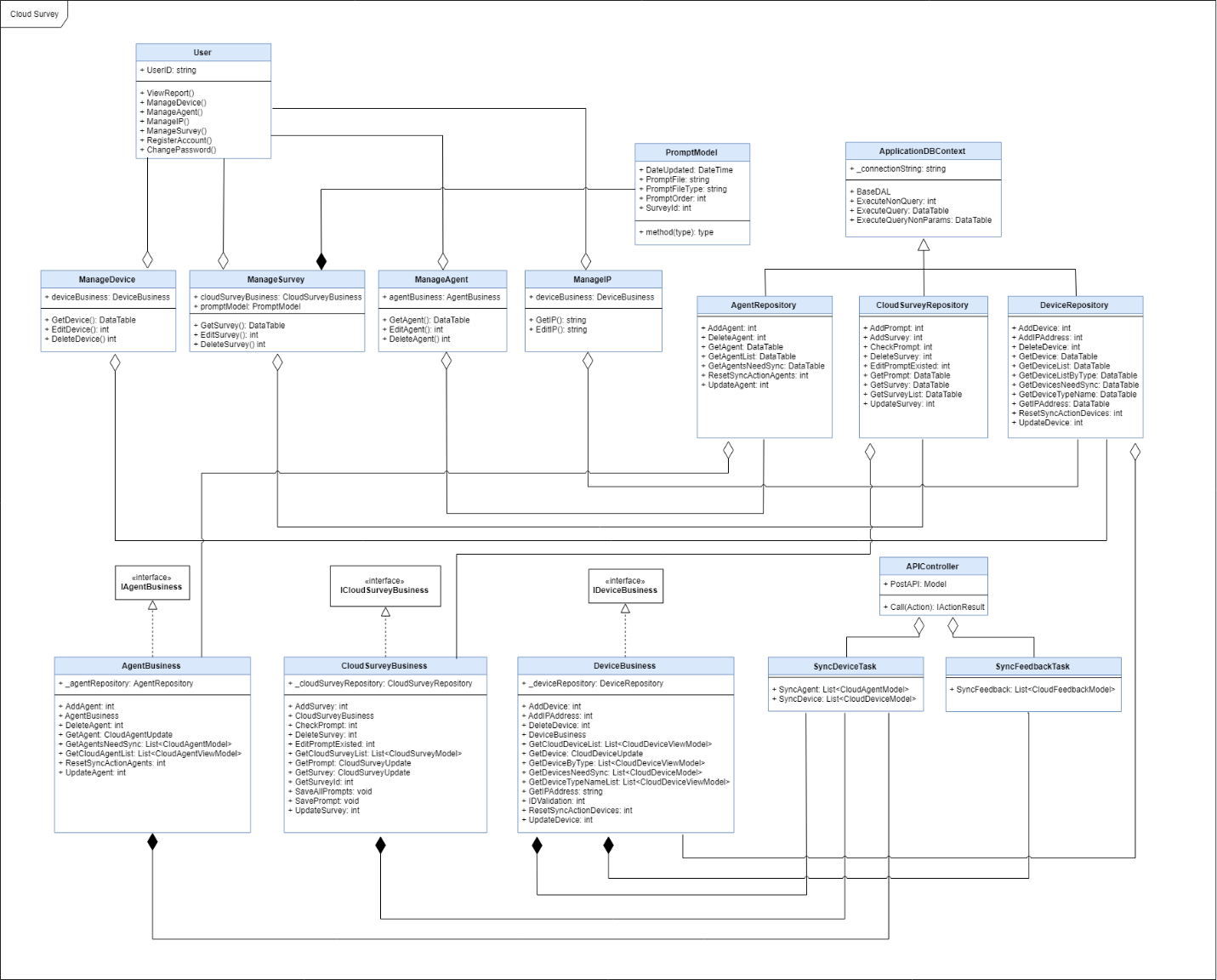


Image 22. Class diagram[3]

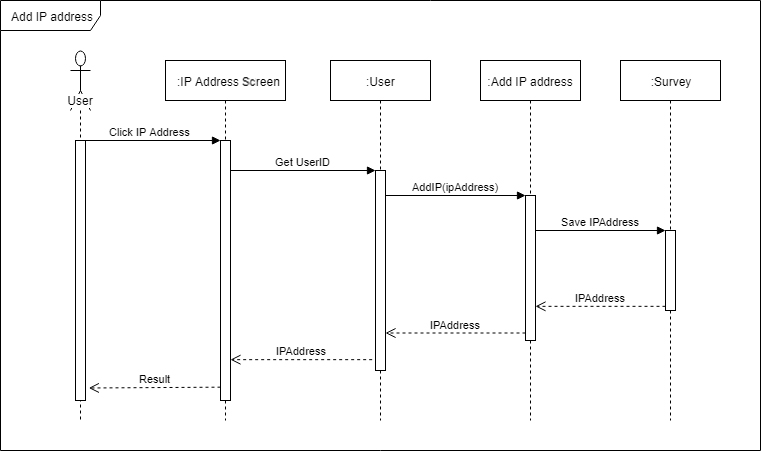
**List of classes are used in the project**

Table 22. List of classes

|  |  |  |
| --- | --- | --- |
| No. | Class Name | Purpose |
| 1 | User | User class is used to identify user |
| 2 | ManageDevice | ManageDevice class is used to manage device of call center |
| 3 | ManageAgent | ManageAgent class is used to manage agent of call center |
| 4 | ManageSurvey | ManageSurvey class is used to manage survey of call center |
| 5 | ManageIP | ManageIP class is used to manage IP of call center |
| 6 | PromptModel | PromptModel class is used to contain of attributes of Prompt |
| 7 | ApplicationDBContext | ApplicationDBContext class used to contain of methods for connect to database |
| 8 | AgentRepository | AgentRepository class used to contain methods of related to agent |
| 9 | CloudSurveyRepository | CloudSurveyRepository class used to contain methods of related to survey |
| 10 | DeviceRepository | DeviceRepository class used to contain methods of related to device |
| 11 | AgentBusiness | AgentBusiness class used to contain methods of related to the agent software business |
| 12 | CloudSurveyBusiness | CloudSurveyBusiness class used to contain methods of related to the survey software business |
| 13 | DeviceBusiness | DeviceBusiness class used to contain methods of related to the device software business |
| 14 | APIController | Supply method to run an action may be call API to synchronized |
| 15 | SyncDeviceTask | Supply method to run an action may be call API to synchronized for agent and device on LinkScope Lite |
| 16 | SyncFeedbackTask | Supply method to run an action may be call API to synchronized for feedback on LinkScope Lite |

## **2.5. Sequence diagram**

**2.5.1. Add IP address**

  
Image 23. Add IP address sequence diagram

**2.5.2. Create agent**

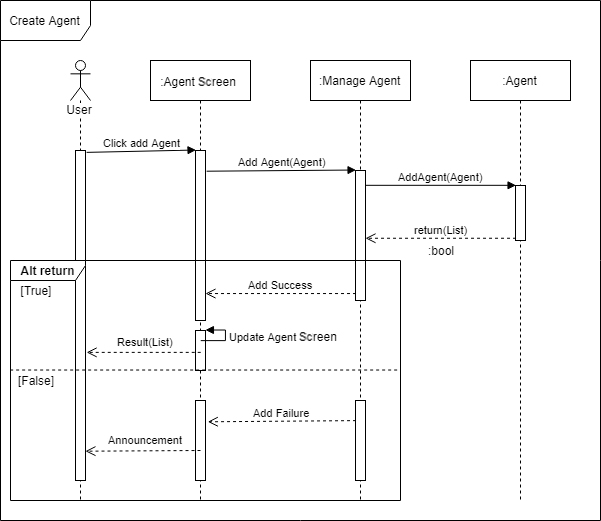


Image 24. Create agent sequence diagram

**2.5.3. Create device**

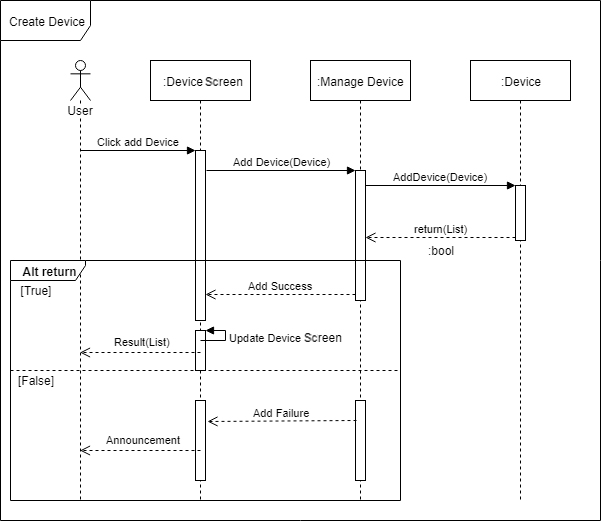


Image 25. Create device sequence diagram

**2.5.4. Create survey**

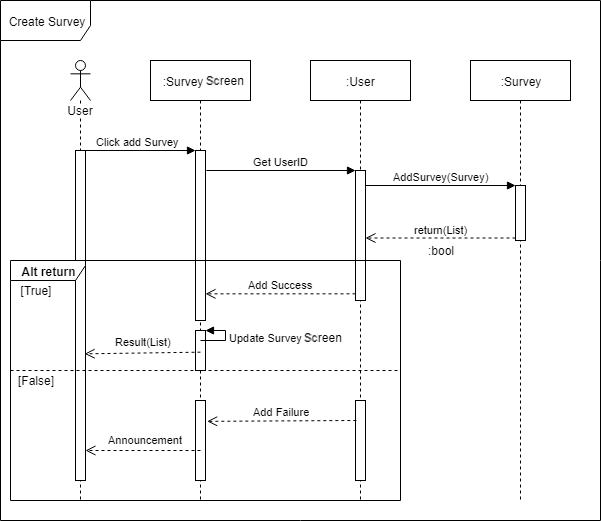
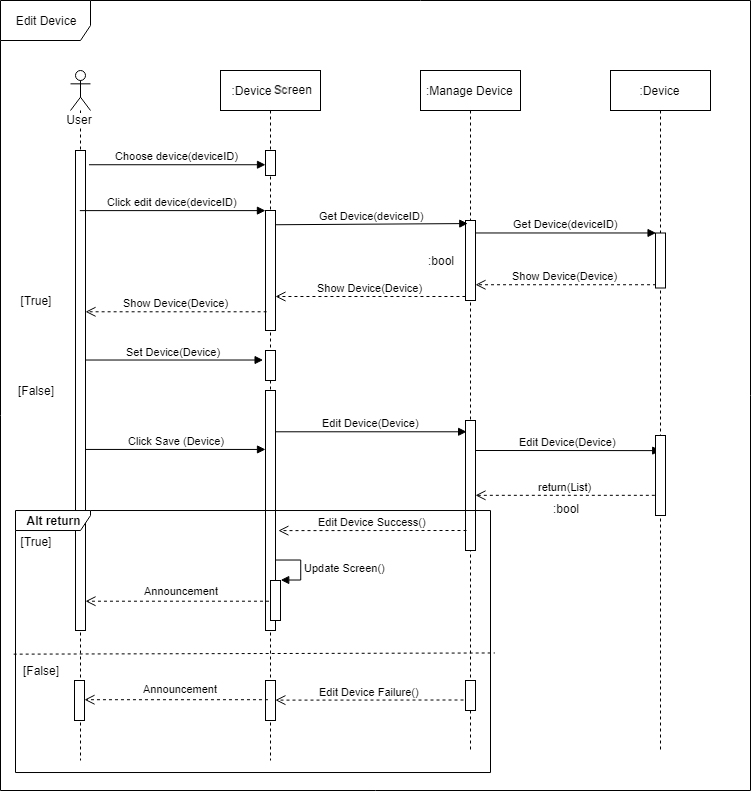


Image 26. Create survey sequence diagram

**2.5.5. Edit device**

  
Image 27. Edit device sequence diagram

## **2.6. Entity relationship diagram**

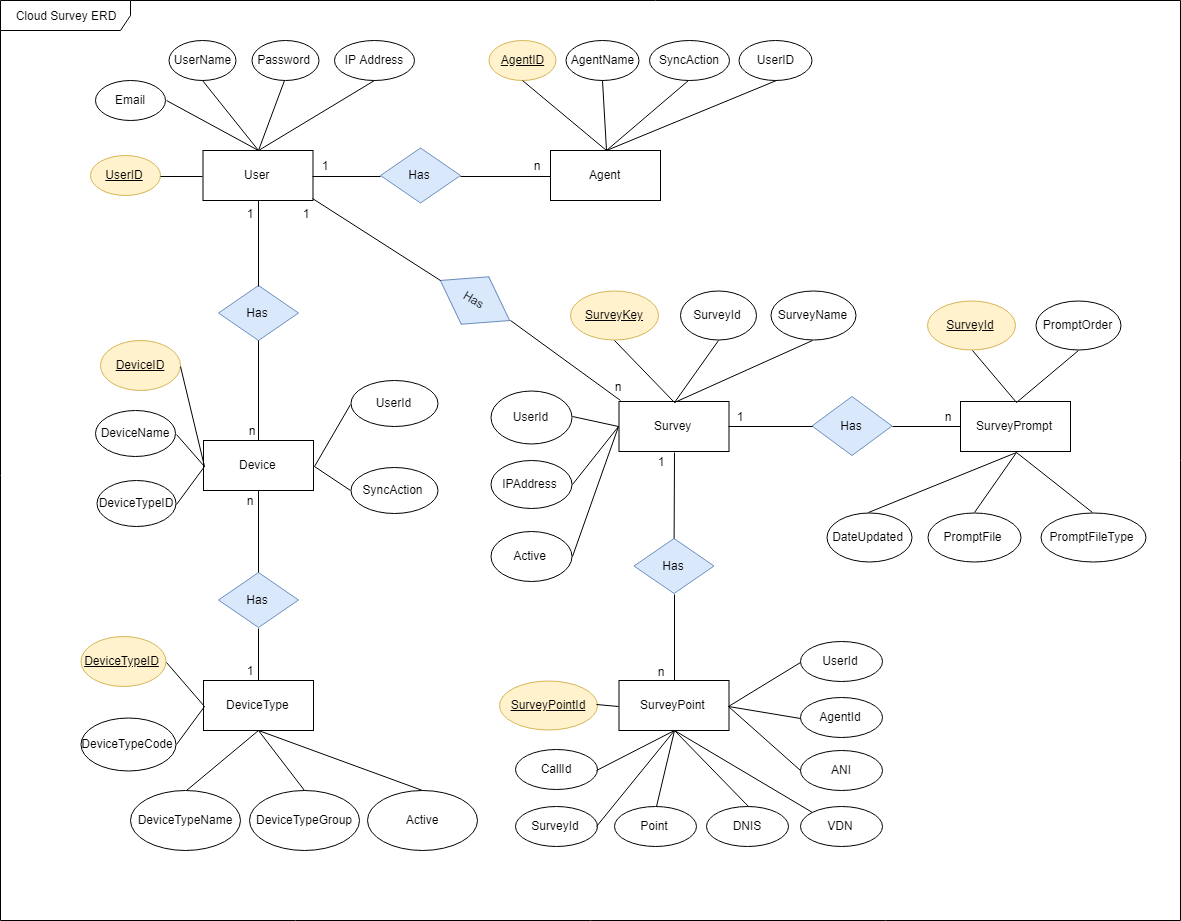


Image 28. Entity relationship diagram

## **2.7. Entity relationship diagram description**

**- User (UserID, Email, UserName, Password, IP Address):** Contains user information, specifically the information of the user who is using the Cloud Survey.

**- Agent (AgentID, AgentName, SyncAction, UserID):** Contains agent information, save agent information and user can manage their agent. They can create a new agent, edit/delete existing agent if needed.

**- Device (DeviceID, DeviceName, DeviceTypeID, UserId, SyncAction):** This table contains device information, user can manage their device. They can create a new device, edit/delete existing device if needed.

**- DeviceType (DeviceTypeID, DeviceTypeCode, Active, DeviceTypeName, DeviceTypeGroup):** This table contains type of device and user can manage their device.

**- Survey (SurveyKey, SurveyId, SurveyName, UserId, IPAddress, Active):** This table contains survey information, call center will be able to manage their survey. They can create a new survey, edit/delete existing survey if needed.

**- SurveyPoint (SurveyPointId, CallId, SurveyId, Point, DNIS, VDN, ANI, AgentId, UserId)**: This table contains feedback from multiple customers and generate report as process, customer does feedback and IVR will save it to database. Background task will synchronize these feedbacks to LinkScope Report Cloud via API, LinkScope Report Cloud will save feedbacks to database and generate report by Reporting Service.

**- SurveyPrompt (SurveyId, PromptOrder,** **DateUpdated, PromptFile, PromptFileType):** This table contains prompt (audio) of the user when creating a new survey, edit their survey.

## **2.8. Configuration**

- MySQL database management must be installed on Linux OS and work properly.

- Asterisk must be installed and work properly on Linux OS.

- Install PHP on Linux OS.

# ***3. Project implementation***

## **3.1. Environment**

- Integrated Development Environment: Visual Studio 2017.

- Programming language: C#, PHP.

- Framework: Microsoft .NET Core v2.0, PHPAGI.

- Database management systems: MySQL Server.

- Operating System: Debian 9 OS, Microsoft Windows 10 64bit.

## **3.2. Work assignment**

Table 33. Work assignment

|  |  |  |
| --- | --- | --- |
| Task | Student’s name | Evaluate contribution |
| Design UI | Tran Tan Quy  Nguyen Mai Hung | 35% 65% |
| Coding Asterisk dial plan | Tran Tan Quy | 100% |
| Coding the web app | Tran Tan Quy Nguyen Mai Hung | 30% 70% |
| Design Class Diagram | Nguyen Mai Hung | 100% |
| Design Usecase | Tran Tan Quy | 100% |
| Design Sequence diagram | Nguyen Mai Hung | 100% |
| Design ERD | Nguyen Mai Hung | 100% |
| Testing and debugging | Tran Tan Quy  Nguyen Mai Hung | 50% 50% |
| Writing report. | Tran Tan Quy  Nguyen Mai Hung | 60%  40% |

## **3.3. Work plan**

Table 34. Work plan

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| BUILDING CLOUD SURVEY APP | | | | | | | | | | | | | | | |
| No. | Goal | Schedule | | | | | | | | | | | | Quy | Hung |
| 1 | Understand requirement. | **o** | **o** |  |  |  |  |  |  |  |  |  |  | 🗸 | 🗸 |
| 2 | Describe project requirement. | **o** | **o** |  |  |  |  |  |  |  |  |  |  | 🗸 | 🗸 |
| 3 | Design Usecase diagram. |  | **o** | **o** |  |  |  |  |  |  |  |  |  | 🗸 |  |
| 4 | Design Class diagram |  |  |  |  |  | **o** | **o** | **o** |  |  |  |  |  | 🗸 |
| 5 | Design Sequence diagram |  |  |  |  |  |  |  | **o** | **o** | **o** |  |  |  | 🗸 |
| 6 | Design ERD diagram |  |  |  |  |  |  |  |  | **o** | **o** | **o** |  |  | 🗸 |
| 7 | Design user interface (UI) |  | **o** | **o** | **o** | **o** |  |  |  |  |  |  |  | 🗸 | 🗸 |
| 8 | Implement Login/Register User page |  |  | **o** | **o** | **o** |  |  |  |  |  |  |  |  | 🗸 |
| 9 | Implement Survey List/Manage page |  |  |  |  |  | **o** | **o** | **o** | **o** | **o** |  |  | 🗸 | 🗸 |
| 10 | Build survey reports |  |  |  |  |  |  | **o** | **o** | **o** | **o** |  |  |  | 🗸 |
| 11 | Reporting Service and ASP.NET Core |  |  |  |  |  |  |  | **o** | **o** | **o** | **o** | **o** |  | 🗸 |
| 12 | Build survey reports |  |  |  |  |  | **o** | **o** | **o** |  |  |  |  |  | 🗸 |
| 13 | Create Device Management page |  |  |  |  |  |  | **o** | **o** | **o** |  |  |  | 🗸 |  |
| 14 | Learning Asterisk dial plan |  | **o** | **o** | **o** | **o** |  |  |  |  |  |  |  | 🗸 |  |
| 15 | Asterisk: Build IVR base on SIP\_Header info |  |  |  | **o** | **o** | **o** |  |  |  |  |  |  | 🗸 |  |
| 16 | Asterisk: Save feedback info |  |  |  | **o** | **o** | **o** |  |  |  |  |  |  | 🗸 |  |
| 17 | Testing and debugging the project. |  |  |  |  |  |  |  |  |  | **o** | **o** |  | 🗸 | 🗸 |
| 18 | Writing a report. |  |  |  |  |  |  |  |  |  |  | **o** | **o** | 🗸 | 🗸 |
| Day | | 25/02/2019 | 04/03/2019 | 11/03/2019 | 18/03/2019 | 25/03/2019 | 01/04/2019 | 08/04/2019 | 15/04/2019 | 22/04/2019 | 29/04/2019 | 06/05/2019 | 13/05/2019 |  |  |
| Week | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |  |  |
| Note | | **o** – Begin  **o** – Complete 50%  **o** – Complete 100% | | | | | | | | | | | | | |

# ***4. Manual instruction***

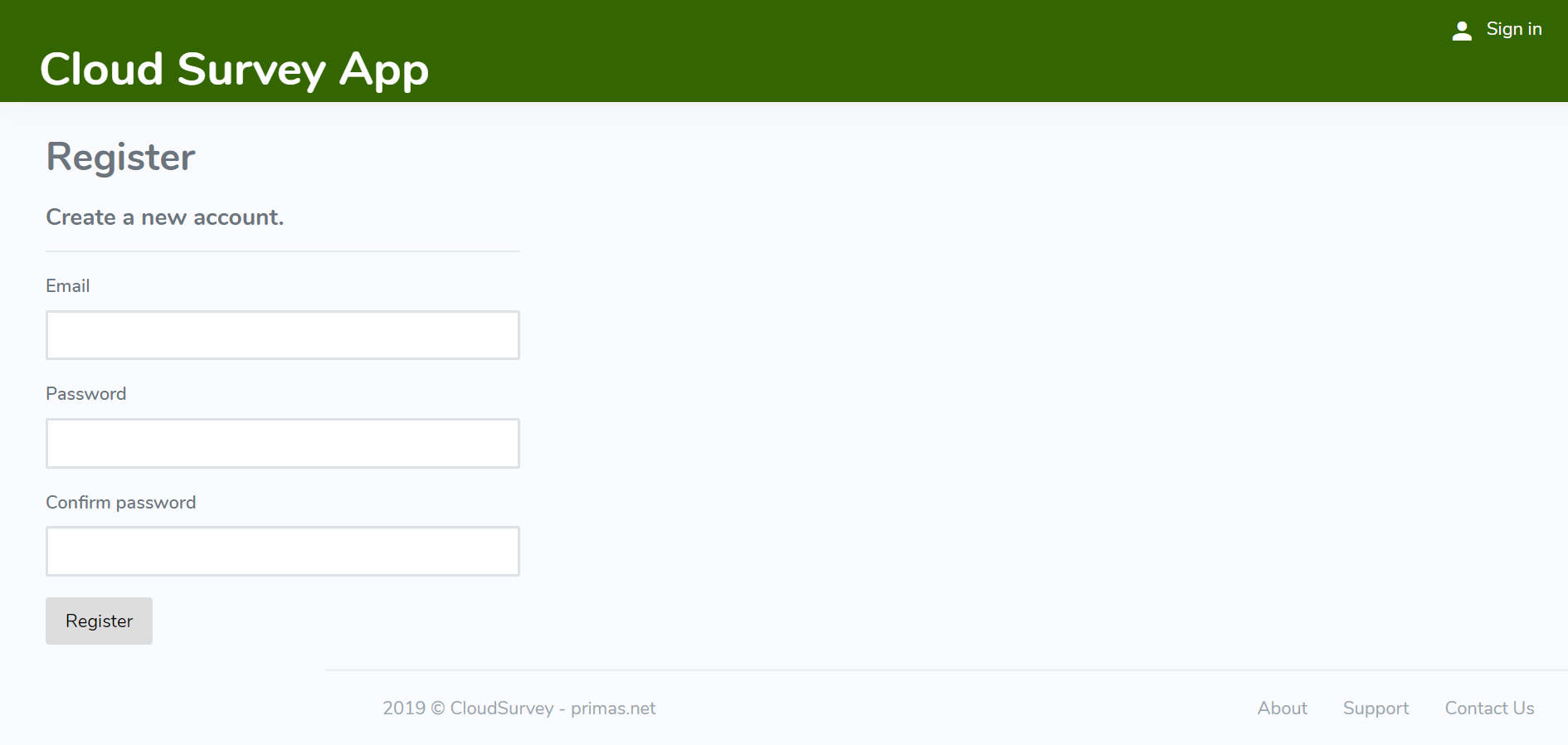
- When a guest first accesses to Cloud Survey App, they will need to register a new account to log in the web app. 

Image 29. Manual instruction for registration

- Guest needs to type the email and password twice (password must be strong) for registration. After that, click ‘Register’ button to register a new account. When they registered successfully, the web app will automatically sign in for them.

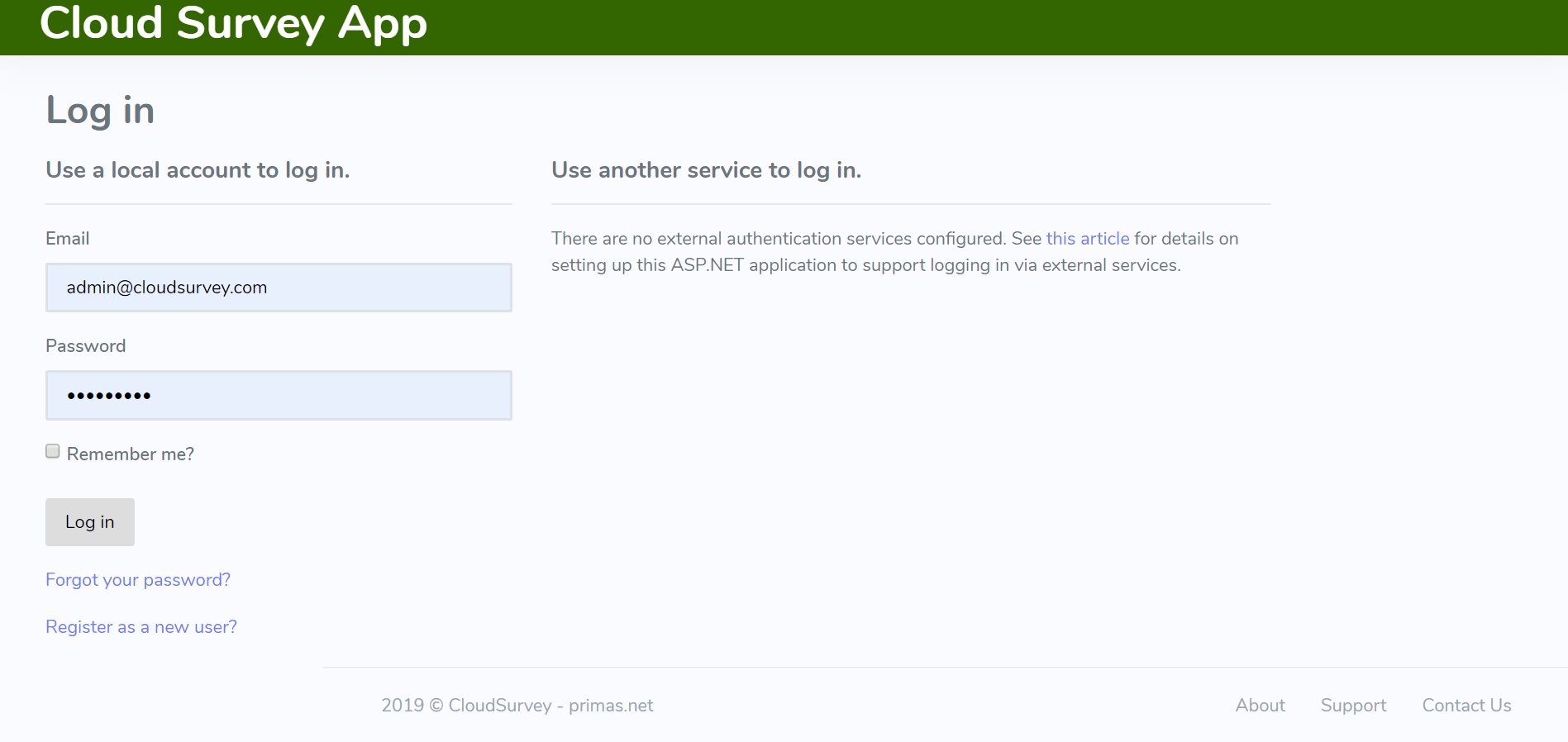


Image 30. Manual instruction for login

- If they already have an account, simply click ‘Sign in’ to log in. After that, type email and password then click ‘Log in’ button to log in.

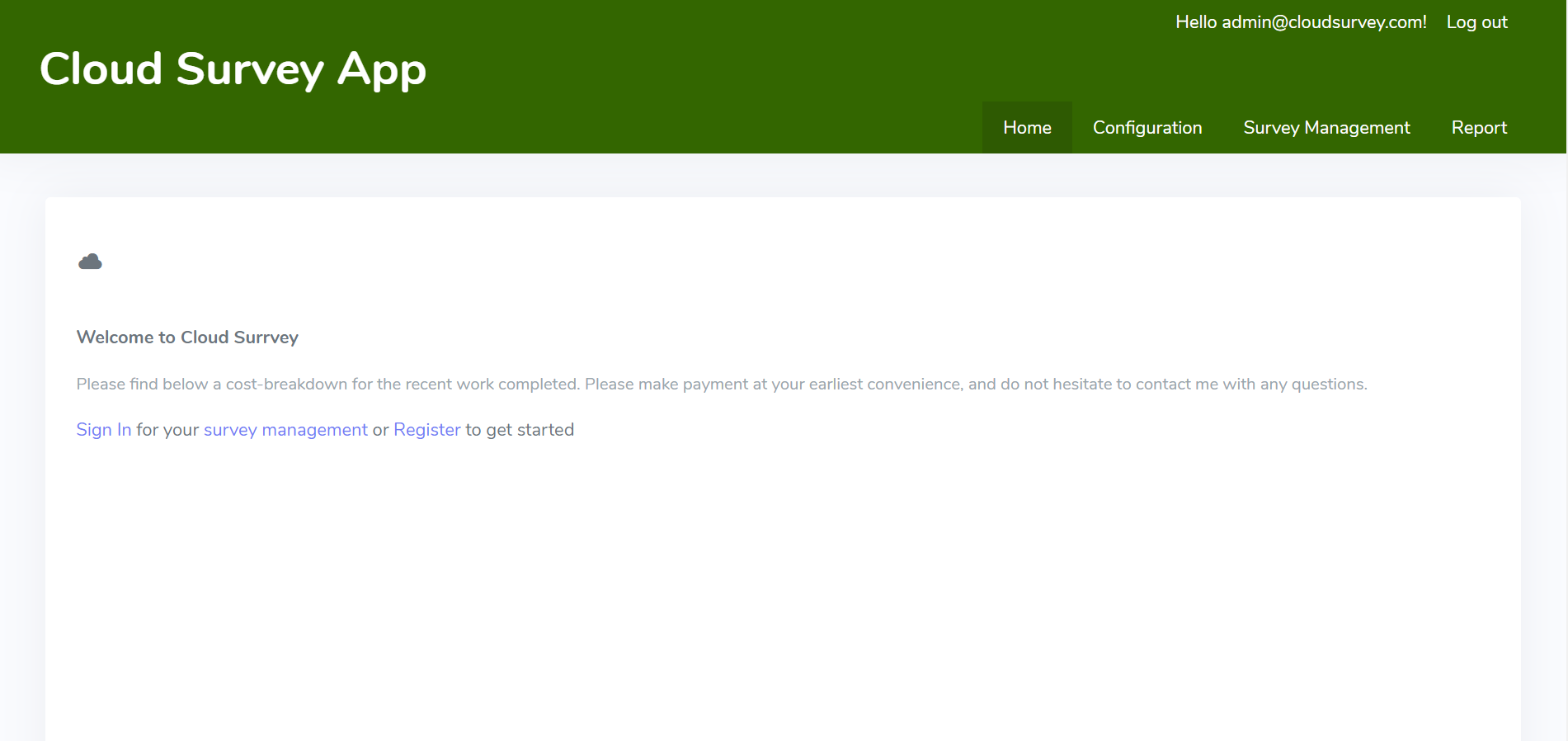


Image 31. Manual instruction for main page

- When user successfully logged in, they can start working with ‘Configuration’, ‘Survey Management’ and ‘Report’.

**Configuration**

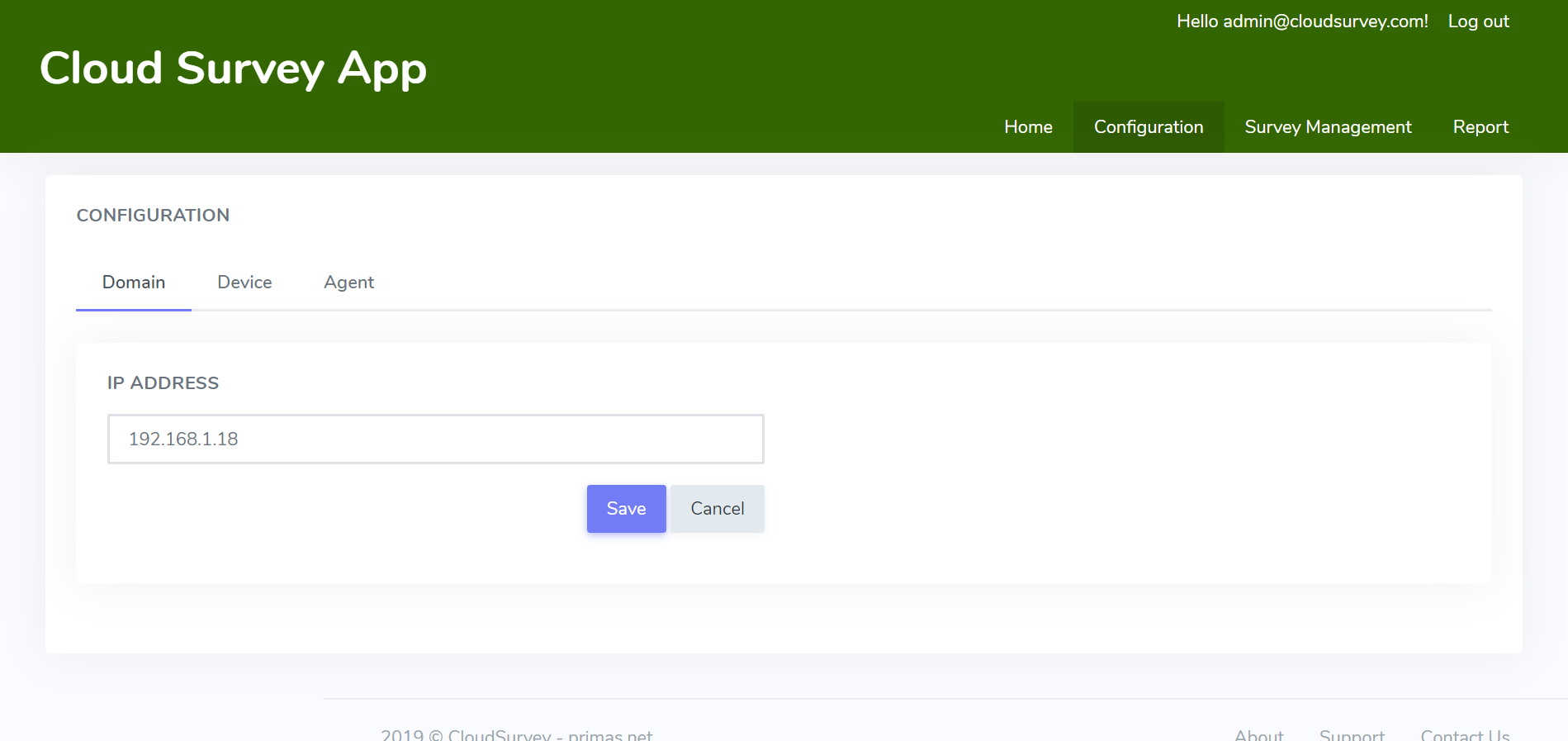


Image 32. Manual instruction for Configuration

- With ‘**Domain**’ tab inside Configuration, user can add the call center’s IP address or edit the current IP address by entering a valid IP address and click ‘Save’ button.

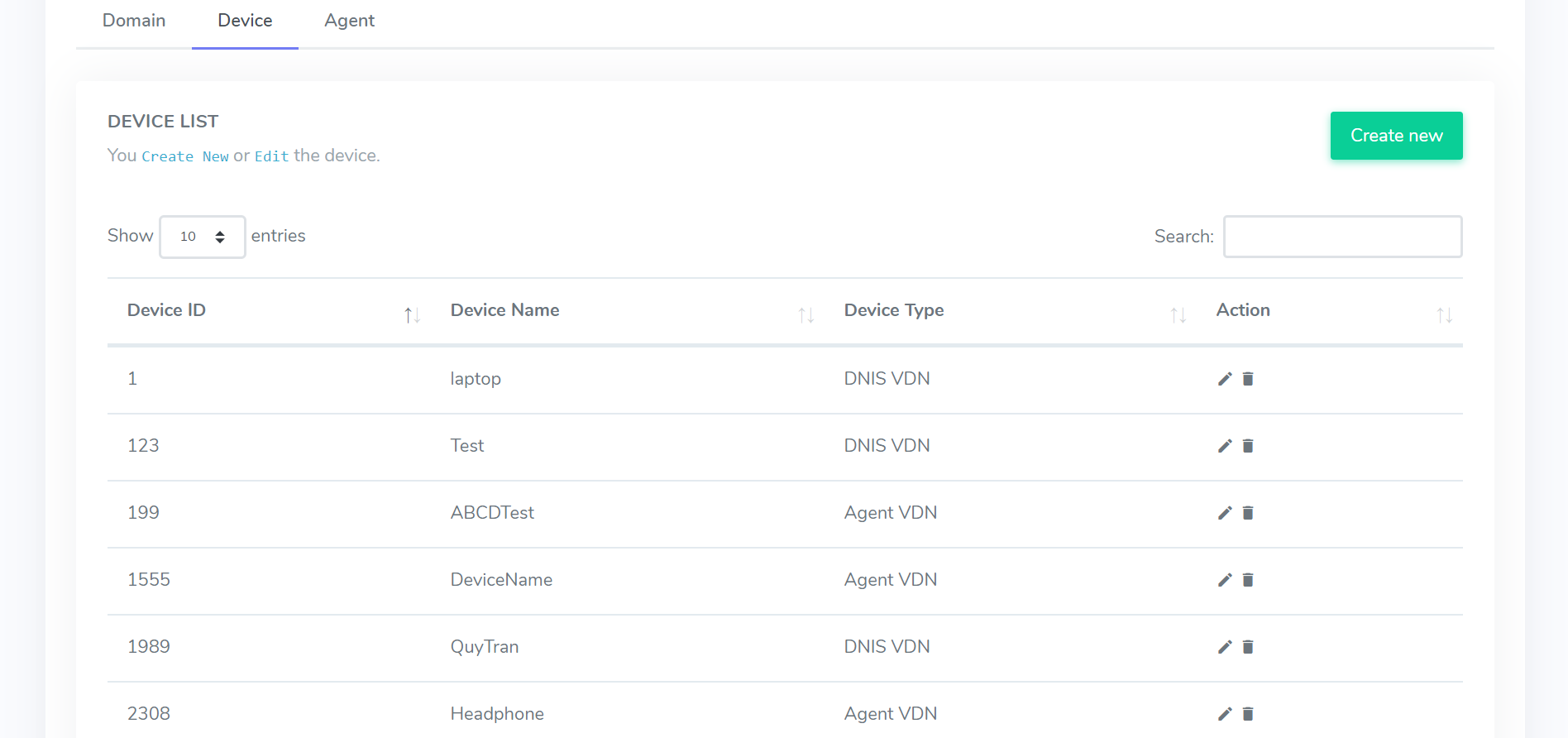


Image 33. Manual instruction for Device

- With ‘**Device**’ tab, user can add a new device by clicking ‘Create new’ button on top right corner to add a new device. Click  to delete a device.

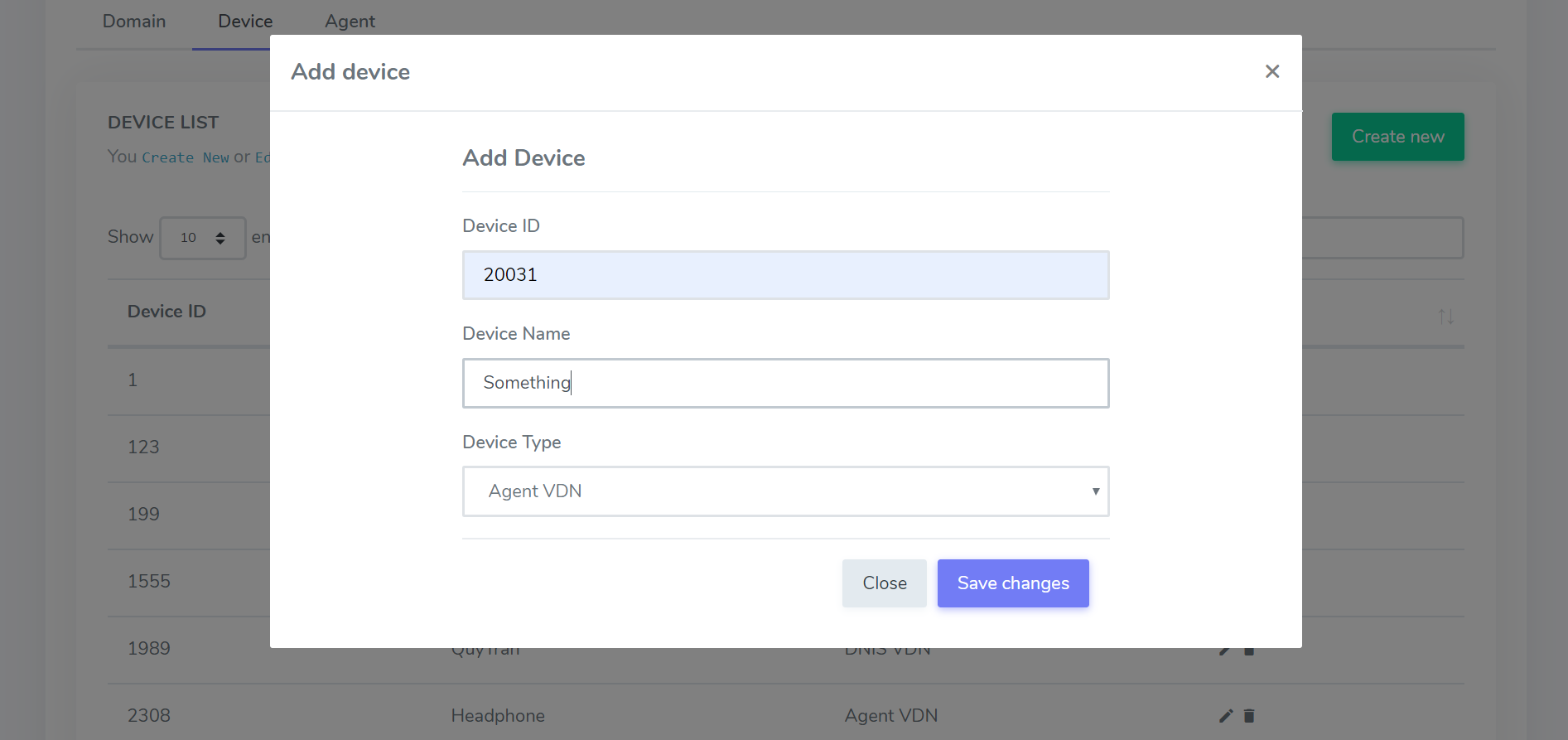


Image 34. Manual instruction for adding device

- User needs to input enough information to the modal then click ‘Save changes’ to save.

- When user needs to edit, click  to edit, do same things just like when user adds a new device.

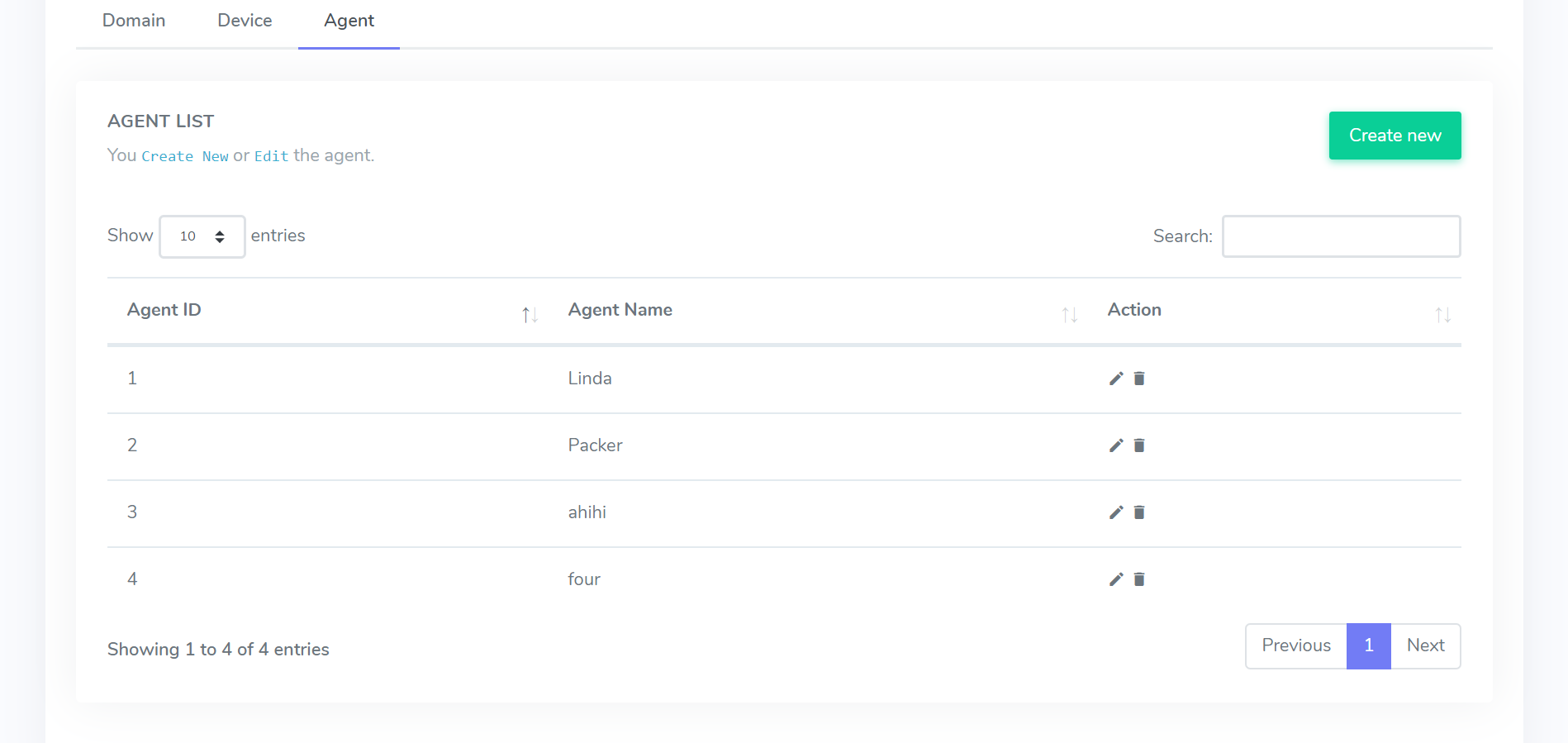


Image 35. Manual instruction for Agent

- With ‘**Agent**’ tab, follow the same instructions of ‘Device’ tab to perform actions.

**Survey Management**

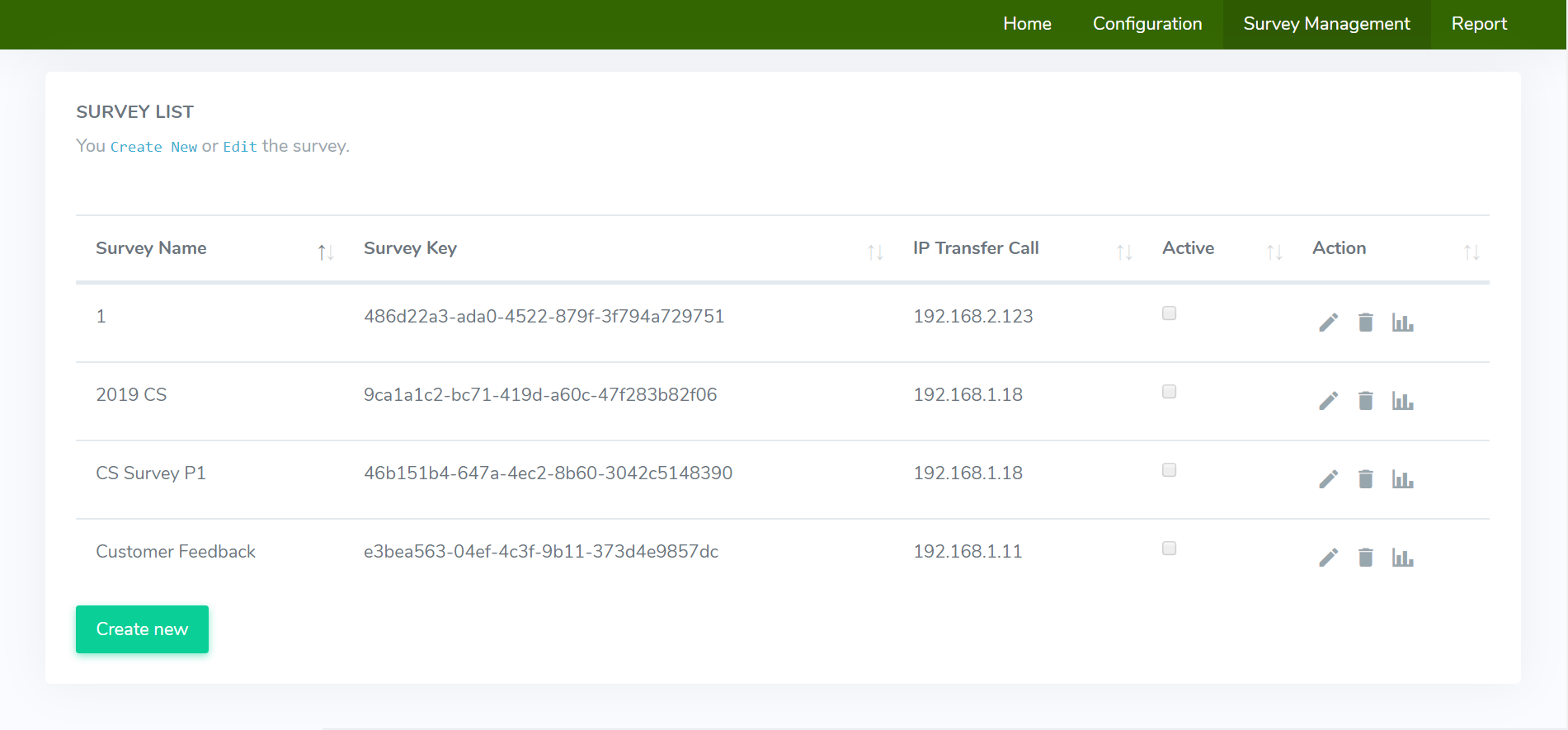


Image 36. Manual instruction for Survey Management

- User can add a new survey by clicking ‘Create new’ button on below left corner to add a new survey, click  to delete a survey, click  to view report.

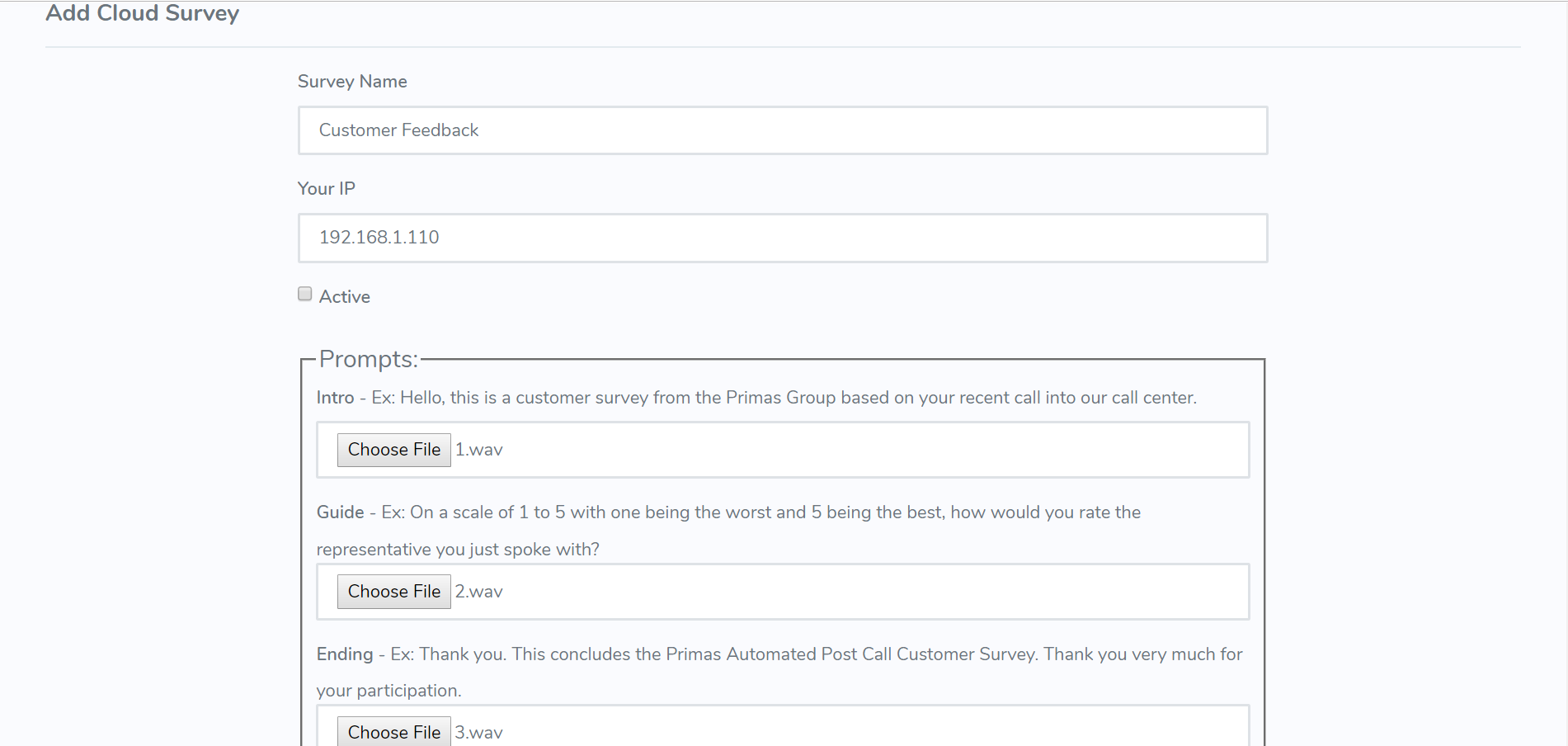


Image 37. Manual instruction for adding survey

- User needs to input enough information and upload 3 .wav files (sample rate of .wav file must be at 8k Hz) then click ‘Create’ to create a new survey.

- When user needs to edit, click  to edit, do same things just like when user adds a new survey.

**Report**

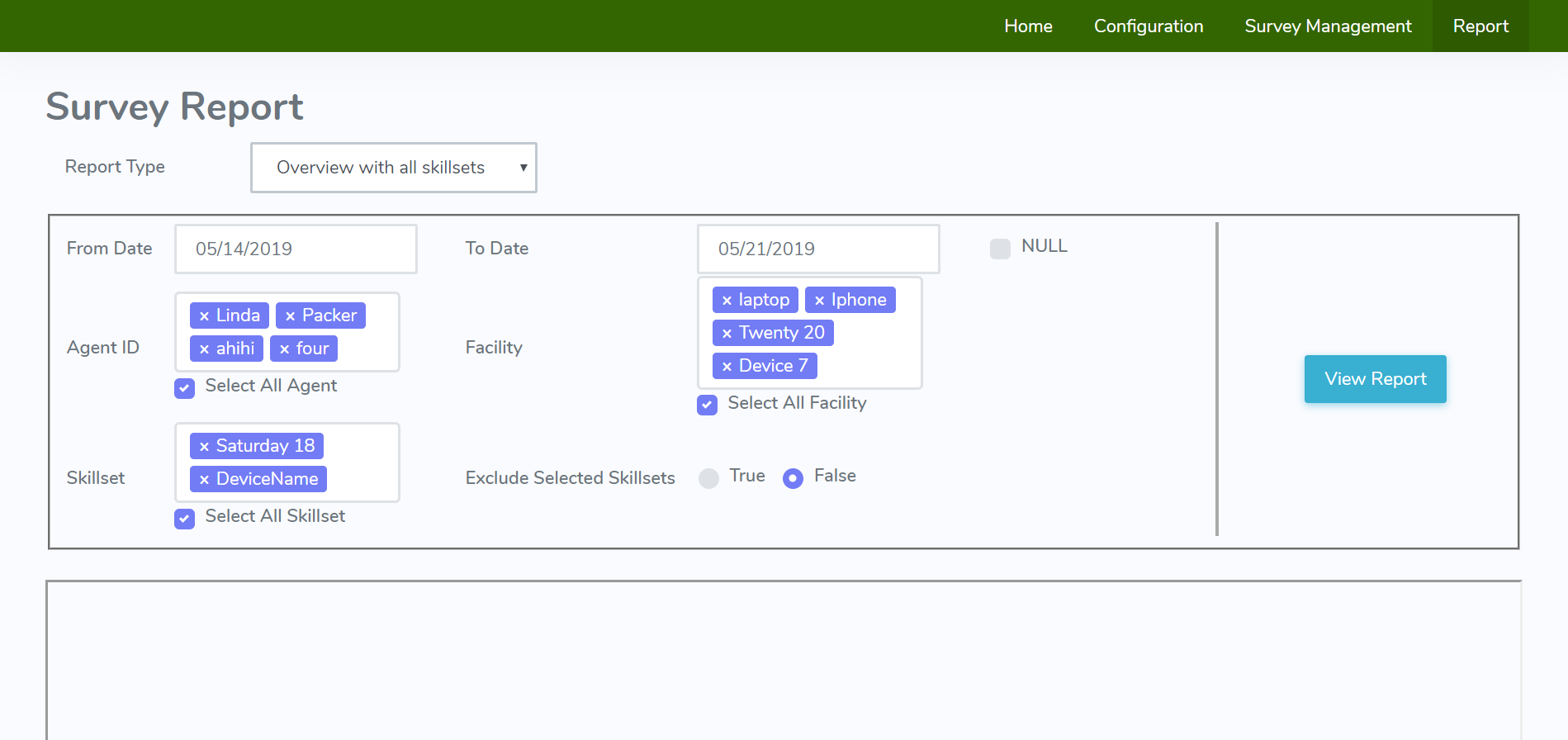


Image 38. Manual instruction for Report

- To view reports, user needs to field/choose enough information then click ‘View report’ button to view report.

# ***5. Conclusion***

## **5.1. Results**

- Caller can receive/answer the IVR survey and give feedback for the survey.

- Call center can register account, customize survey and do configuration for device, agent, IP address.

- Created a functional web app for Cloud Survey App.

- Can store survey feedback and upload it to Survey Report Server.

## **5.2. Difficulties**

- Asterisk and its dial plan are new for us and not easy to get used to at first.

- ASP.NET Core was also a new technology for us.

- Don't have implemented text-to-speech for user to create audio file

## **5.3. Solutions**

- After some weeks of researching about Asterisk and ASP.NET Core, we are able to get started and work with these technologies.

## **5.4. Advantages**

- The web app is built with ASP.NET Core which is cross-platform and reusable.

- The web app UI are easy to use.

## **5.5. Disadvantages**

- Survey only has 1 question so far.

- Code might not be optimized.

- User can only upload prepared audio file so far.

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## **5.6. Developing ideas**

- Implement a text survey and let call center’s customers rate by sending message.

- Implement text-to-speech to web app for user to create survey audio files as survey questions and upload it to server beside uploading prepared audio file.

## **5.7. Source code**

# **REFERENCES**

[1] Asterisk, Get Started, <https://www.asterisk.org/get-started>, accessed 19th May, 2019.

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