Project Acronym: **BIMERR**
Project Full Title: **BIM-based holistic tools for Energy-driven Renovation of existing Residences**
Grant Agreement: **820621**
Project Duration: **42 months**

DELIVERABLE D5.5
Building Information Collection Application for building residents 1

Deliverable Status: **Final**
File Name: **BIMERR_D5.5-v1.0**
Due Date: **31/10/2020 (M22)**
Submission Date: **31/10/2020 (M22)**
Task Leader: **SUITE5 (T5.3)**

Dissemination level	
Public	x
~~Confidential, only for members of the Consortium (including the Commission Services)~~	

This project has received funding from the European Union's Horizon 2020 Research and innovation programme under Grant Agreement n°820621

The BIMERR project consortium is composed of:		
FIT	Fraunhofer Gesellschaft Zur Foerderung Der Angewandten Forschung E.V.	Germany
CERTH	Ethniko Kentro Erevnas Kai Technologikis Anaptyxis	Greece
UPM	Universidad Politecnica De Madrid	Spain
UBITECH	Ubitech Limited	Cyprus
SUITE5	Suite5 Data Intelligence Solutions Limited	Cyprus
HYPERTECH	Hypertech (Chaipertek) Anonymos Viomichaniki Emporiki Etaireia Pliroforikis Kai Neon Technologion	Greece
MERIT	Merit Consulting House Sprl	Belgium
XYLEM	Xylem Science And Technology Management Gmbh	Austria
CONKAT	Anonymos Etaireia Kataskevon Technikon Ergon, Emporikon Viomichanikonkai Nautiliakon Epicheiriseon Kon'kat	Greece
BOC	Boc Asset Management Gmbh	Austria
BX	Budimex Sa	Poland
UOP	University Of Peloponnese	Greece
UEDIN	University of Edinburgh	United Kingdom
UCL	University College London	United Kingdom
NT	Novitech As	Slovakia
FER	Ferrovial Agroman S.A	Spain

Disclaimer

BIMERR project has received funding from the European Union's Horizon 2020 Research and innovation programme under Grant Agreement n°820621. The sole responsibility for the content of this publication lies with the authors. It does not necessarily reflect the opinion of the European Commission (EC). EC is not liable for any use that may be made of the information contained therein.

Authors List

Leading Author (Editor)			
Surname	First Name	Beneficiary	Contact email
Bountouni	Nefeli	Suite5	nefeli@suite5.eu

Co-authors (in alphabetic order)				
#	Surname	First Name	Beneficiary	Contact email
1	Athanasiadou	Georgia	UOP	gathanas@uop.gr
2	Giannakis	Giorgos	HYPERTECH	g.giannakis@hypertech.gr
3	Katsigarakis	Kyriakos	UCL	k.katsigarakis@ucl.ac.uk
4	Kousouris	Spiros	Suite5	spiros@suite5.eu
5	Lampathaki	Fenareti	Suite5	fenareti@suite5.eu
6	Lilis	Georgios	UCL	g.lilis@ucl.ac.uk
7	Lucerski	Maciej	BX	maciej.lucerski@budimex.pl
8	Tsoulos	George	UOP	gtsoulos@uop.gr
9	Zieliński	Marcin	BX	drmarcin.zielinski@budimex.pl

Reviewers List

List of Reviewers (in alphabetic order)				
#	Surname	First Name	Beneficiary	Contact email
1	Bosche	Frederic	UEDIN	f.bosche@ed.ac.uk
2	Lilis	Georgios	UCL	g.lilis@ucl.ac.uk

Revision Control

Version	Author	Date	Status
0.10	Suite5	12/10/2020	Draft ToC
0.20	Suite5	16/10/2020	Draft Sections 1, 2
0.30	Suite5	23/10/2020	Draft Sections 3, 4
0.40	Suite5	26/10/2020	Draft version sent for Internal Quality Check
0.50	Suite5	31/10/2020	Updated version to address the comments received during the Internal Quality Check
1.0	Suite5	02/11/2020	Final draft for submission to the EC

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACRONYMS

Acronym	Meaning
API	Application Programming interface
BICA	Building Information Collection Application
BIM	Building Information Model
BIF	BIMERR Interoperability Framework
BIMERR	BIM-based holistic tools for Energy-driven Renovation of existing Residences
DoA	Description of Action
PRUBS	Profiling Residents Usage of Building Systems

EXECUTIVE SUMMARY

The main scope of the BIMERR Deliverable D5.5 - "Building Information Collection Application for Building Residents 1" is to accompany the BIMERR Building Information Collection Application (BICA) and conclude the first iteration of the development activities undertaken under the context of T5.3 "Building Information Collection Application (BICA) for Building Residents". Overall, the BICA smartphone app constitutes one of the main digital building model creation tools delivered under the context of WP5 "As-is Building Information Extraction & Model Population Tools".

BICA is addressed to building residents to collect their feedback before a renovation project starts, enabling them to provide complementary information (such as notes and photos) to the already recorded building information of their building's BIM model; thus, accelerating the overall collection of data required for the initial renovation scenario modelling process. Furthermore, BICA captures information about the actual comfort status of the residents to help improve comfort profiling. Finally, BICA acts as an information point between the renovation contractor and the building residents, where users (i.e. building residents) can report any issues regarding the building components/equipment present in their premises.

In more detail, the aim of this deliverable is to provide the specs for the BICA smartphone application, document the functionalities delivered, the technology stack it builds upon, the APIs it exposes, the installation instructions and the usage walkthrough for its users. In its first version, the BIMERR BICA offers a fully-functional application that implements a subset of the features envisaged for the final version, following a 2-iteration design and delivery plan as planned in the BIMERR DoA.

The final release of the BICA smartphone application, due to be delivered on M30 of the BIMERR project implementation and documented in D5.6, shall focus on integrating the full set of final functionalities, and enhance the end-to-end user experience, based on the feedback received during the testing and experimentation of the BICA application in the pre-validation sites.

1. INTRODUCTION

1.1 SCOPE AND OBJECTIVES

The present deliverable D5.5, entitled "Building Information Collection Application (BICA) for building residents 1" describes the activities undertaken within the context of Task T5.3 – "Building Information Collection Application (BICA) for Building Residents" of WP5 "As-is Building Information Extraction & Model Population Tools", towards the delivery of the first version of the BICA smartphone application. The BICA smartphone application acts as a bi-directional information point between the renovation delivery team and building residents, enabling the latter to provide complementary information (such as notes and photos) to the already recorded building information. In this way they contribute to the constant update of their building's BIM model and as built documentation, while accelerating the overall collection of data required for the initial renovation scenario modelling process. BICA will also enable residents to provide more information about their current comfort status, that will be used for the improvement of their comfort profiling (in T5.4). In addition, through BICA, building residents can report issues/faults with the equipment in their apartments.

The main scope of D5.5 is to deliver a comprehensive overview and a documentation report of the first release of BICA. Since this deliverable is of type "Demonstrator", it provides the documentation of the actual software that has been developed (for the first version) and delivered in accordance with the BIMERR requirements and architecture. More specifically, D5.5 provides an overview of the functionalities of the BICA smartphone application along with its architecture and details the specifications of its design and development, by:

- Defining the technology stack, upon which it is built.
- Documenting the Application Programming Interfaces (APIs), i.e. endpoints which will enable the required communications and information exchanges with the BIMERR Interoperability Framework (BIF).
- Clarifying any assumptions and restrictions considered for the first version of the application.
- Providing the installation instructions in order to run the application.
- Identifying the accompanying licensing of the application.

- Offering a usage walkthrough through a set of step-by-step instructions supplemented with screenshots to explain in detail the functionalities of BICA.

As explicitly stated in the BIMERR DoA [1], BICA will be delivered in two versions, in M22 and M30 of the project's implementation. The final version of BICA shall be refined on the results of this deliverable and will contain all the planned functionalities, as well as improvements derived from the updated outcomes of the WP5 activities and the feedback received from the testing of the application during the pre-validation activities of WP8.

1.2 RELATION TO OTHER TASKS/DELIVERABLES

The present deliverable D5.5, documents the activities performed in Task T5.3 "Building Information Collection Application (BICA) for Building Residents" and its main scope is to deliver the first version of the BICA smartphone application. Towards this direction, for the design and implementation of the application described in this deliverable, the current document receives input from the following BIMERR deliverables:

- D3.1 "Stakeholder requirements for the BIMERR system" [2], which documents the key BIMERR stakeholders and their requirements, along with a thorough description of the system requirements, business scenarios and use cases that define the user stories that prescribe the different features to be supported by this smartphone application.
- D3.6 "BIMERR system architecture 2nd version" [4], where the second version of the BIMERR architecture is provided along with the revised BICA specifications and functional requirements.
- D4.2 "BIMERR Ontology & Data Model 1" [5], including among others, the Occupancy and Sensor data models, that were taken into consideration for the design of BICA.
- D4.4 "BIMERR Building Semantic Modelling tool 1" [6], providing the technical specifications and usage walkthrough of the BIF's Building Semantic Modelling Component.
- D4.6 "BIMERR Information Collection & Enrichment Tool 1" [7], that documents the technical specifications and provides a usage walkthrough of the BIF's information Collection & Enrichment Component.

- D4.8 “Integrated BIMERR Interoperability Framework 1” [8], that provides the technical details and a usage walkthrough of the Query Builder and the Information Secure Provisioning Components of the BIF.
- D7.1 “Populated Material/Component Database 1” [11], that concludes the first iteration of the development activities in T7.1 “Building Components Database Design & Development” and provides information on the BIMERR Material and Component Database.

The outcome of the activities performed in the context of D5.5 will be also used as input in the following deliverables, tasks and work packages:

- T5.1 “BIM Platform Adaptation for Efficient Renovation Support” where the residents’ component- and room-related information could be used by the architects, renovation managers etc., to update the current BIM model of the apartment.
- T5.4 “Profiling Residents Usage of Building Systems (PRUBS)” where the residents’ comfort input functionality of BICA will be utilised in PRUBS, by refining and adjusting accordingly the modeling parameters towards the extraction of more accurate comfort profiles.
- T7.5 “Decision Support System Engine and UI & Module Integration” that will develop the renovation decision support system and can utilise issues reported by residents through BICA to optimize the renovation scenarios based on user needs.

In addition, D5.5 and its main outcome the BICA smartphone application for residents, form part of the overall BIMERR toolkit delivered within the context of WP5 “As-is Building Information Extraction & Model Population Tools”. The developed application will be tested during the pre-validation activities performed in WP8 to assess its operational effectiveness and provide feedback and lessons learnt from the real-life usage towards the delivery of its final version; and thereafter in the validation and evaluation activities performed in the project’s demonstration sites in WP9.

1.3 STRUCTURE OF THE DOCUMENT

In order to address all the aspects relevant to the scope of D5.5, this deliverable has been structured as follows:

- Section 1 introduces the work performed and the scope of this deliverable, along with its relevance to other BIMERR tasks and the deliverable's structure.
- Section 2 provides an overview of the main functionalities of the BIMERR Building Information Collection Application, its architecture and a comprehensive documentation detailing the design and development principles followed.
- Section 3 offers an end-to-end usage walkthrough of the application along with step-by-step instructions, accompanied by appropriate screenshots to explain in detail the functionalities and usage of the BICA application.
- In Section 4, conclusions are provided along with the release plan for the final version of the BIMERR BICA smartphone application.

2. BICA DESIGN & DEVELOPMENT

2.1 OVERVIEW

The overall scope of the BICA smartphone application is to provide the means for an accelerated collection of building related data, required for the initial renovation scenario modelling process, before any actual renovation works start. Through BICA, building residents can contribute spontaneously, or at the request of the building surveyors/engineers, to the constant update of their building's pre-designed BIM model and as-built documentation by providing complementary information (such as notes and photos). In addition, building residents can report through BICA any issues and faults related to their building, apartment, or specific equipment/components. Supplementary to the above and towards increased information provision, the BICA application enables end users (i.e. building residents) to monitor near real-time conditions in their apartment and provide feedback on their comfort status against the ambient conditions.

Under this context, the main services and functionalities provided by the BICA are reported in more detail:

- **Visualization of room-specific aggregated information of equipment and ambient conditions:** BICA enables building residents to navigate to the different spaces (i.e. rooms) in their apartment and visualize aggregated information regarding the ambient conditions of each room (such as indoor temperature, humidity and illuminance); in addition, they can view the components/equipment assigned to each specific room.
- **Building equipment management and information enhancement (with regard to the components):** BICA enables building residents to view the various building equipment/components (e.g. HVAC, openings, etc.) present in their apartments and report additional ones which may not be included in the baseline BIM model. Such information is critical in order to achieve a fine-grained modeling of the overall building and to fit the design of the proposed renovation interventions to the actual building usage. Through BICA, building residents are able to provide/update each component's information (e.g. type, manufacturer, model, etc.) in a structured way and assign it to a specific room in their apartment.

- **Projected comfort status visualization and comfort status reporting:** Considering that building occupants' feedback is a valuable source of information towards evaluating environmental design practices and building operations, BICA enables building residents to provide real-time information regarding their comfort status against the current values of temperature and illuminance in their premises. In order to collect their input, an interactive user-friendly approach is provided through the use of a five-point emoji-based scale, where users can select the appropriate emoji corresponding to their comfort status.
- **Reporting a building's problems/weak issues:** BICA acts as an information collection point from the building residents; through its intuitive user interface, building residents can report issues related to a specific room and component through predefined forms (enabling them also to upload a photo and a description of the problem), thus accelerating the overall communication of building problems/weak points to the renovation contractor while also reducing intrusiveness.

With regard to the interactions between BICA and other BIMERR Components, BICA will interact with the BIMERR Interoperability Framework (BIF) in order to: (a) retrieve the spaces ids and names per apartment, as well as the components per space, and (b) provide the issues reported per space, the occupants' actual comfort status and the updated components information. Through BIF, the BICA data will be made available to other BIMERR applications, e.g. the comfort status will be used by PRUBS. BICA will also retrieve aggregated sensor data for indoor conditions per space from BIF and / or the Middleware while interacting with the BIMERR Middleware's Identity Provider to grant access to the appropriate residents per apartment. These interactions are depicted in the following Figure 2-1:

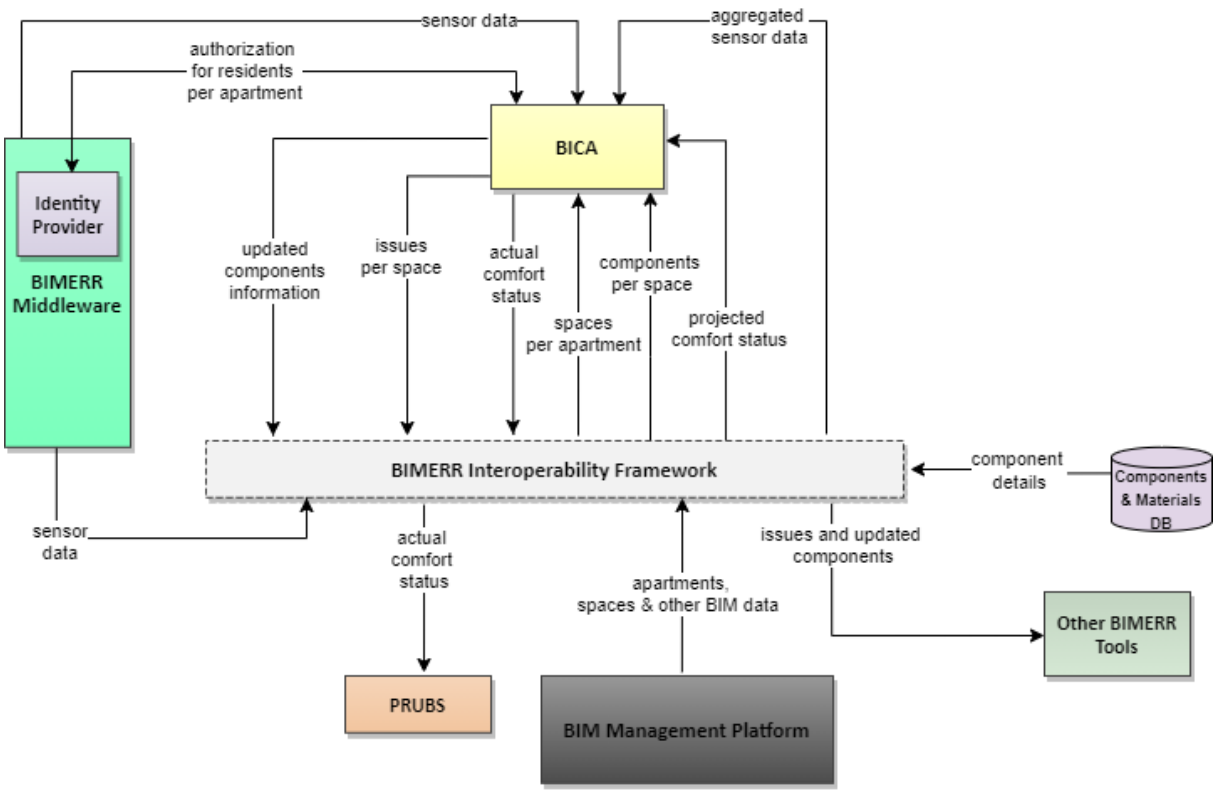

Figure 2-1: Interactions of BICA within BIMERR

2.2 TECHNOLOGY STACK AND IMPLEMENTATION TOOLS

The BICA smartphone application is built on state-of-the-art technologies across 3 layers:

- the Presentation Layer, containing the Mobile Application that is developed in VueNative[1] with the use of NativeBase[2] UI components;
- the Business Logic Layer, containing the different modules of the backend that are based in the Django web framework[3] and the Django REST Framework[4]; and
- the Data Access Layer that essentially refers to the BICA Storage and utilizes PostgreSQL[5]. Such layers along with the different technologies are depicted in the following figure.

[1] https://vue-native.io/
[2] https://nativebase.io/
[3] https://www.djangoproject.com/
[4] https://www.django-rest-framework.org/
[5] https://www.postgresql.org/

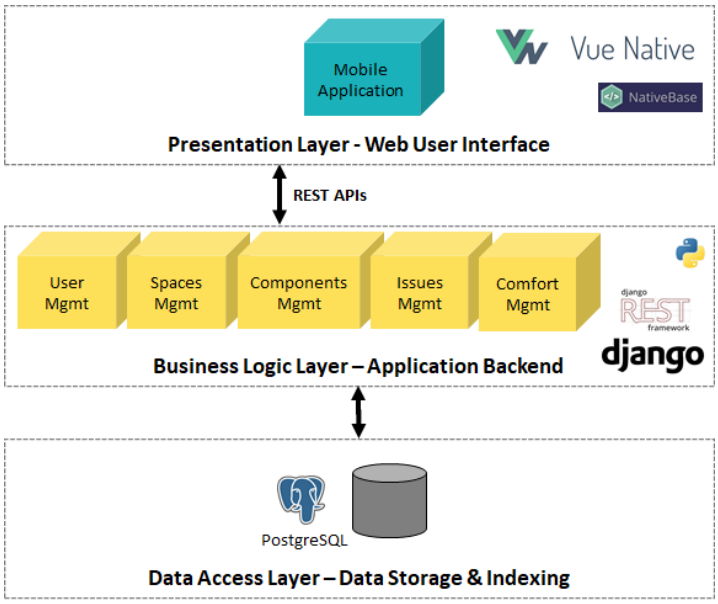

Figure 2-2: BICA Architecture

BICA is written in Python 3.8.2[6] and utilizes the open source technologies defined in Table 2-1.

Table 2-1: Technologies and llibraries used in BICA, along their licenses

Name of the Library	Version	License
Vue Native	0.1.4	MIT
NativeBase	2.13.14	Apache License 2.0
Django	3.1.2	Django OSS License
Django REST Framework	3.12.1	Django REST (Encode OSS) License
PostgreSQL	12.4	PostgreSQL License (similar to BSD/MIT)

2.3 API Documentation

All APIs that accompany the BICA application will be documented in Swagger[7] in its final release.

[6] https://www.python.org/
[7] https://swagger.io/

2.4 ASSUMPTIONS AND RESTRICTIONS

As the development activities for the different BIMERR applications and BIF are still ongoing, the draft release of the BICA application has been provided as a stand-alone application that will be integrated with the BIF and the BIMERR Middleware in its final release. To this end, a number of assumptions (that in certain cases, may represent restrictions for BICA) were taken:

- BICA will communicate with BIF to provide the building-related data provided by occupants. However, in certain cases, the text data (e.g. for reporting issues) are accompanied by photos, for which a link to be made available to BIF to directly retrieve them.
- BICA will retrieve from BIF all necessary information, e.g. regarding the spaces in an apartment, the available components (that have been already identified in the BIM), and the aggregated sensor data. It needs to be noted that, depending on the final granularity of the sensor data and the Wireless Sensor Network installations in the pilot buildings, there is also the alternative to directly retrieve such data from the BIMERR Middleware.
- BICA essentially provides the "apartment" view, so multiple residents may be associated with an apartment. However, one resident cannot live in more than one apartment.
- The process for generating and providing a unique registration key per apartment involves how the residents will acquire them. At the moment, registration to BICA requires such a unique registration key, but if there is any different decision by the Middleware's Identity Provider, the final release of BICA will be appropriately adapted.
- In each component, minimal information is displayed at the moment (as displayed in section 3.5) in order to be as generic as possible. It will be refined once the details for all component types are finalized and retrieved from the BIMERR Materials and Components Database through the BIF.

2.5 INSTALLATION INSTRUCTIONS

Detailed instructions for the BICA deployment are provided in the related private code repository.

2.6 LICENSING

The BIMERR BICA app is a closed source component.

3. END-TO-END USAGE WALKTHROUGH TO BICA

Within this section, the documentation for the BICA application is displayed through a usage walkthrough of the respective functionalities of the app, as an outcome of the development process described in the previous sections. The design of the application has been undertaken in a fully responsive manner to enable visibility from different smartphone devices.

3.1 REGISTRATION & AUTHORIZATION

When the users launch the BICA app, without being already signed-in from a previous session, they are directed to the Login screen (Figure 3-1). If the users already have an account, then they shall just enter the requested fields (username and password) in order to be authenticated and logged-in to the application.

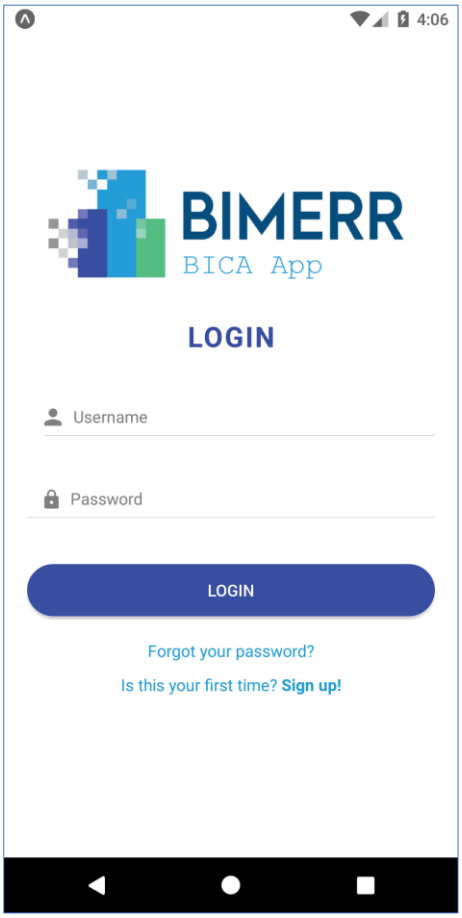

Figure 3-1: Login to BICA

If it is their first registration to the BICA app, the users shall select the relevant option and are directed to the Create Account screen, where they are prompted to create an account, by providing the requested information. This includes a username, a password and the unique registration key per apartment that has been provided to the residents (Figure 3-2).

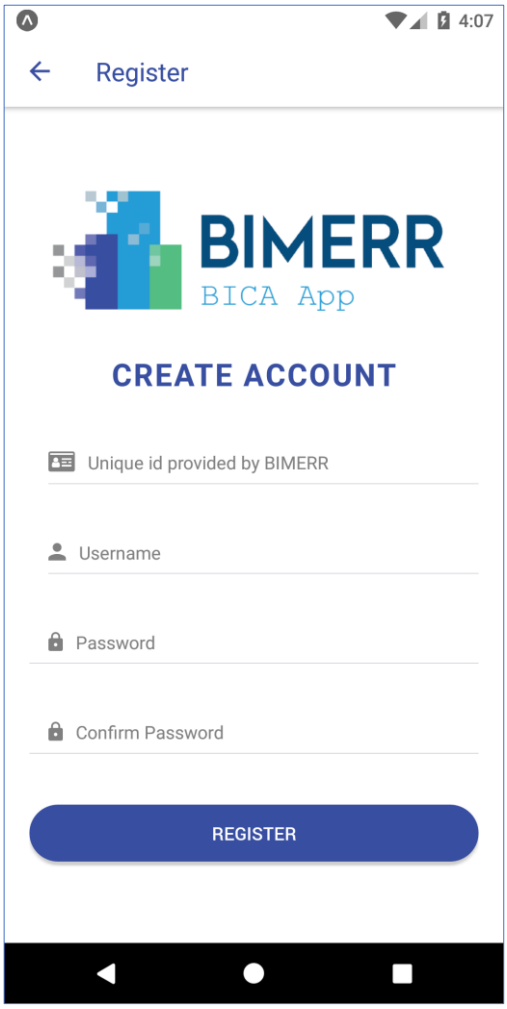

Figure 3-2: Create account

In the event the users have an account, but have forgotten their password, then they can click on the relevant option and are directed to the "Reset password" screen, where they shall enter the requested information (username, new password and unique registration key) in order to create a new password (Figure 3-3).

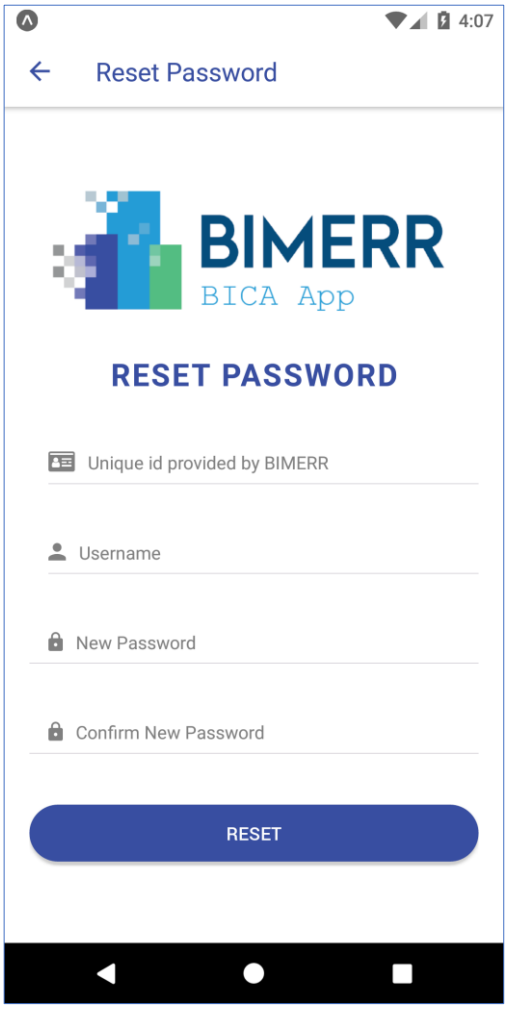

Figure 3-3: Reset password

3.2 MY HOME

Once the users have successfully logged in to their account, they are directed to the "Home" screen of the BICA app, where they have an overview of various details regarding their apartments. In this screen the users can view current weather information and the ambient conditions of their apartments. The users are also provided with a list of icons that will direct them to the other pages of the BICA app (Rooms, Components, Report Issue, Report Log). Furthermore, they can view a list of the components that are registered in their apartment, altogether or grouped per room, and click on them to view more information (Figure 3-4).

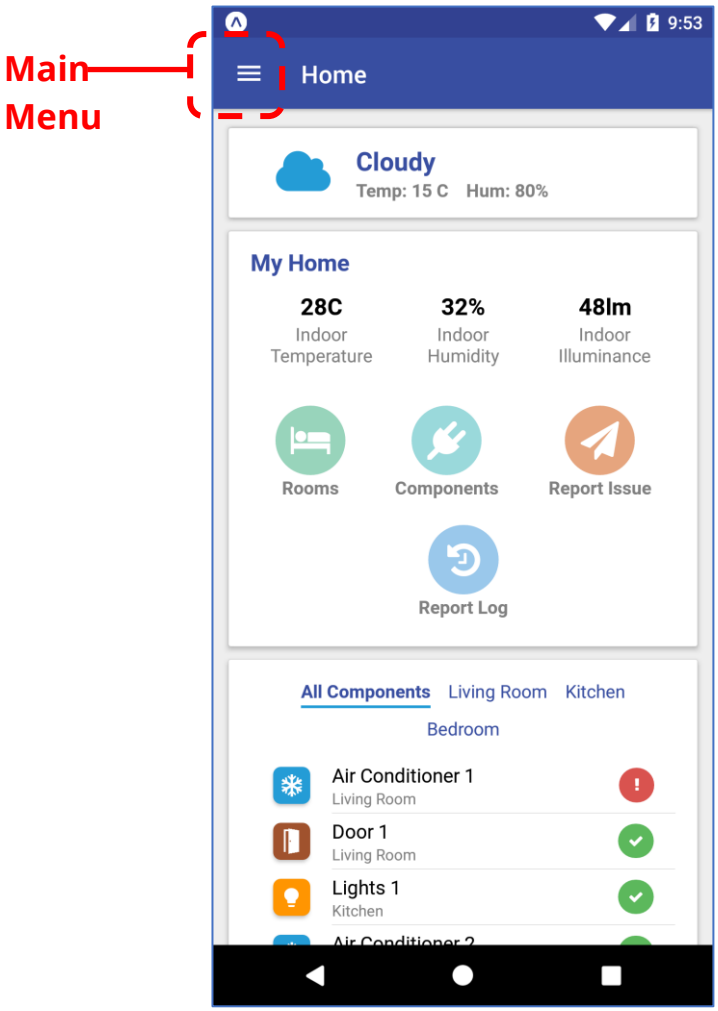

Figure 3-4: View the Home screen

3.3 MAIN MENU

The main menu of the BICA app is available from all pages to the users as a "hamburger" icon in the upper left corner. The users can tap on the icon to open the main menu and view the available application pages (Rooms, Components, Report Log, Report Issue, Settings) or logout from their account (Figure 3-5).

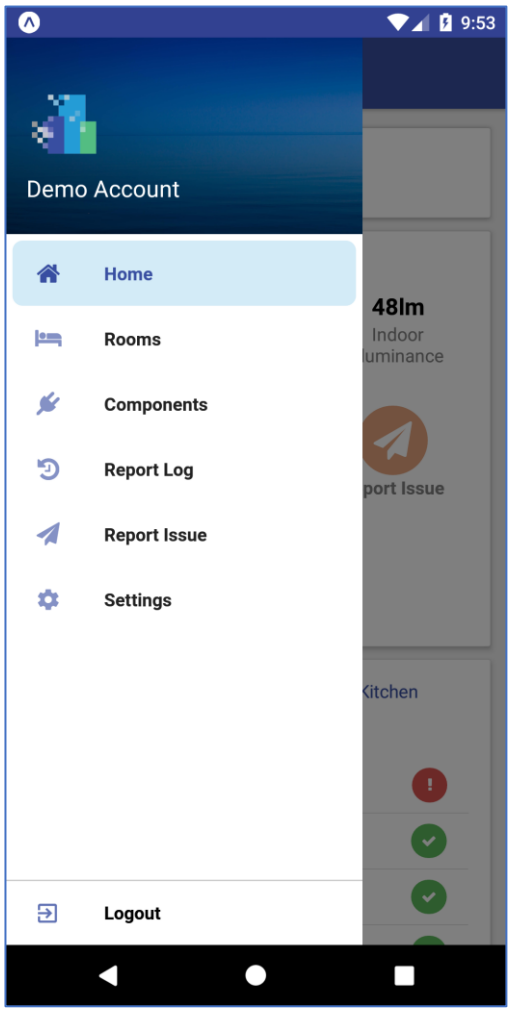

Figure 3-5: View the main BICA menu

3.4 ROOMS - VIEW/ EDIT

By selecting the "Rooms" icon from the Main Menu or the Home Page, the users can view a screen with the rooms of their apartment (Figure 3-6). They can tap on any of the rooms to be directed to the page of the specific room. The users can also report an issue about a room, by using the "Report issue" icon in the bottom right area.

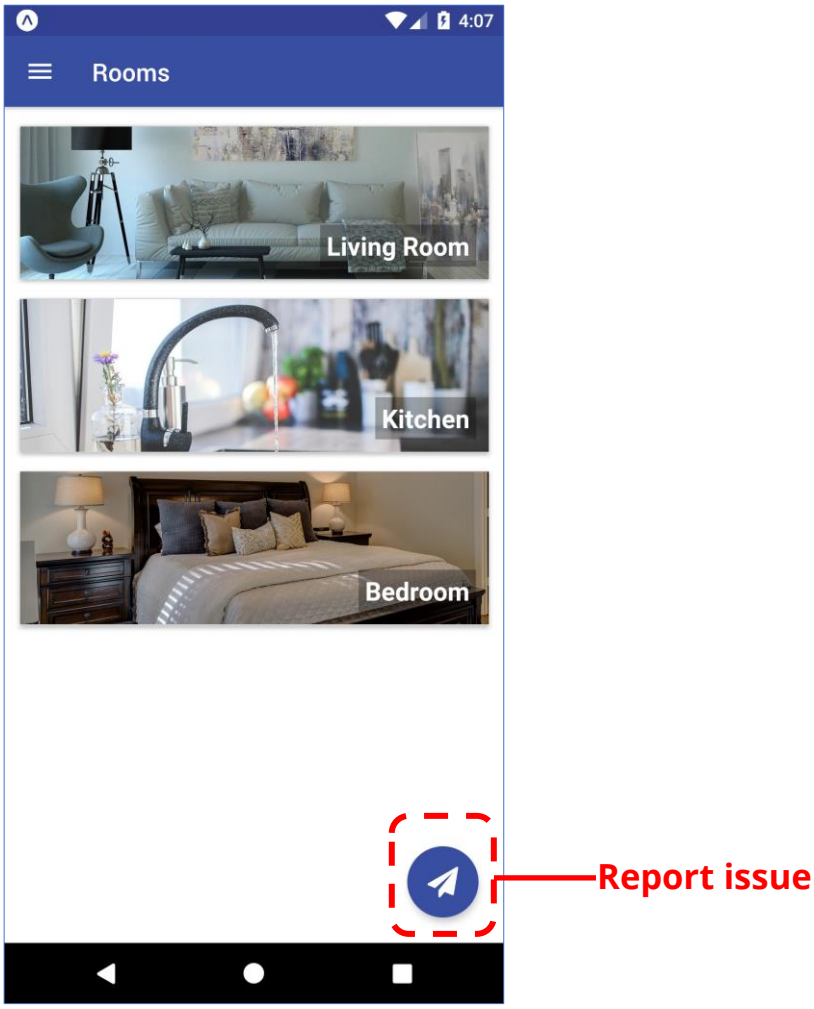

Figure 3-6: View the Rooms of the apartment

When the users select a room from the "Rooms" screen, they are directed to the specific room's page. There they can view information about the ambient conditions in the room, their comfort status and about the components of the specific room (Figure 3-7). They can expand the comfort information by tapping on the down arrow (Figure 3-8). The users can also report an issue for the specific room, by using the "Report issue" icon in the bottom right area.

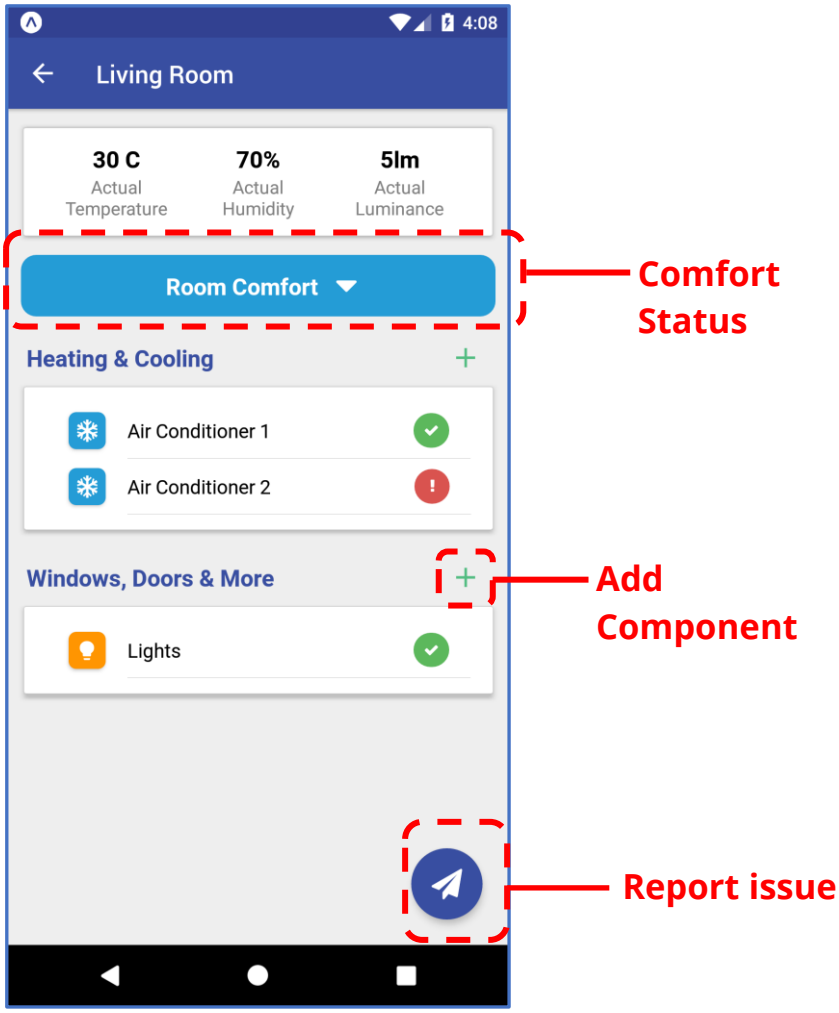

Figure 3-7: View Living Room details

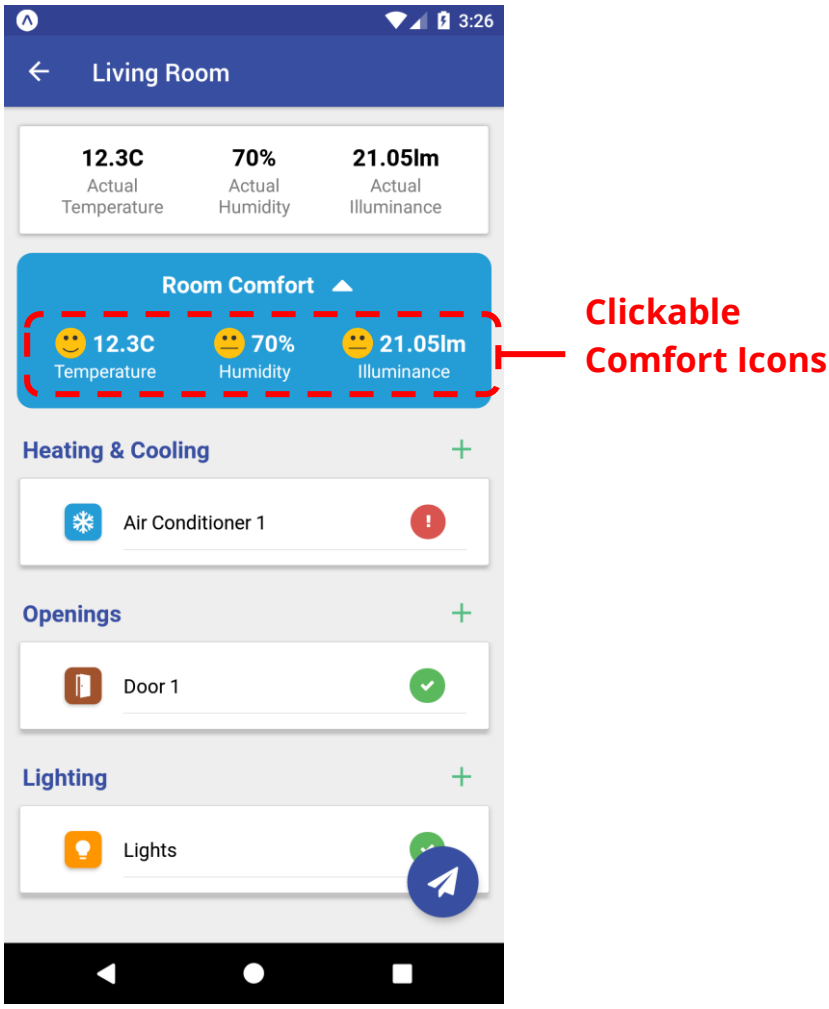

Figure 3-8: View Expanded Comfort information in Living Room

The users can provide their actual comfort status against the set conditions (e.g. temperature) in their room by clicking on the predicted comfort smiley, and selecting the actual status from the pop- up window (Figure 3-9).

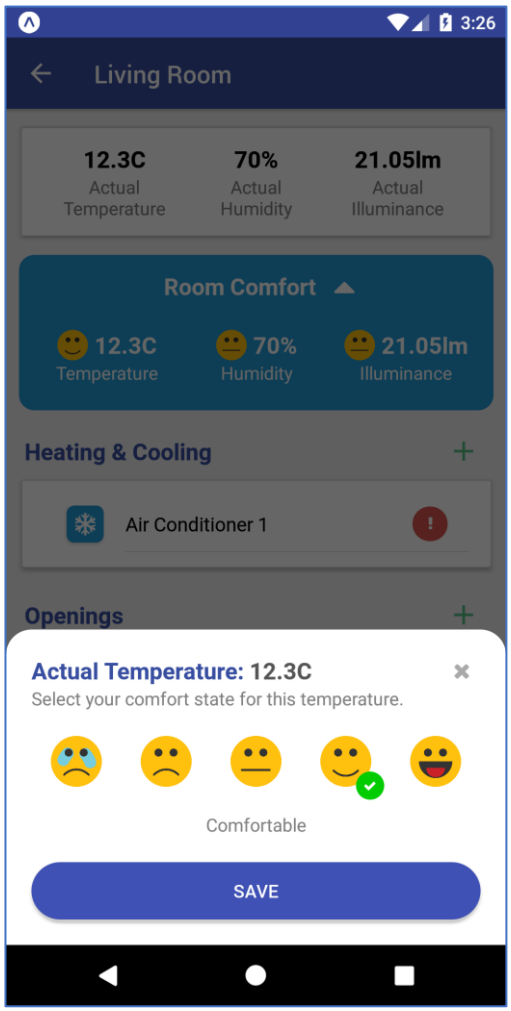

Figure 3-9: Add actual Comfort Status in Living Room

3.5 COMPONENTS - VIEW/EDIT

By selecting the "Components" icon from the Main Menu or the Home Page, the users can view a screen with all the components registered in their apartment, grouped per category type (Figure 3-10). They can tap on any of the components to view more information about the specific component and/or edit some of its details. The users can add a new component to a specific category by tapping on the 'plus' button next to the category name. The users can always report an issue with a component, by using the "Report issue" icon in the bottom right area

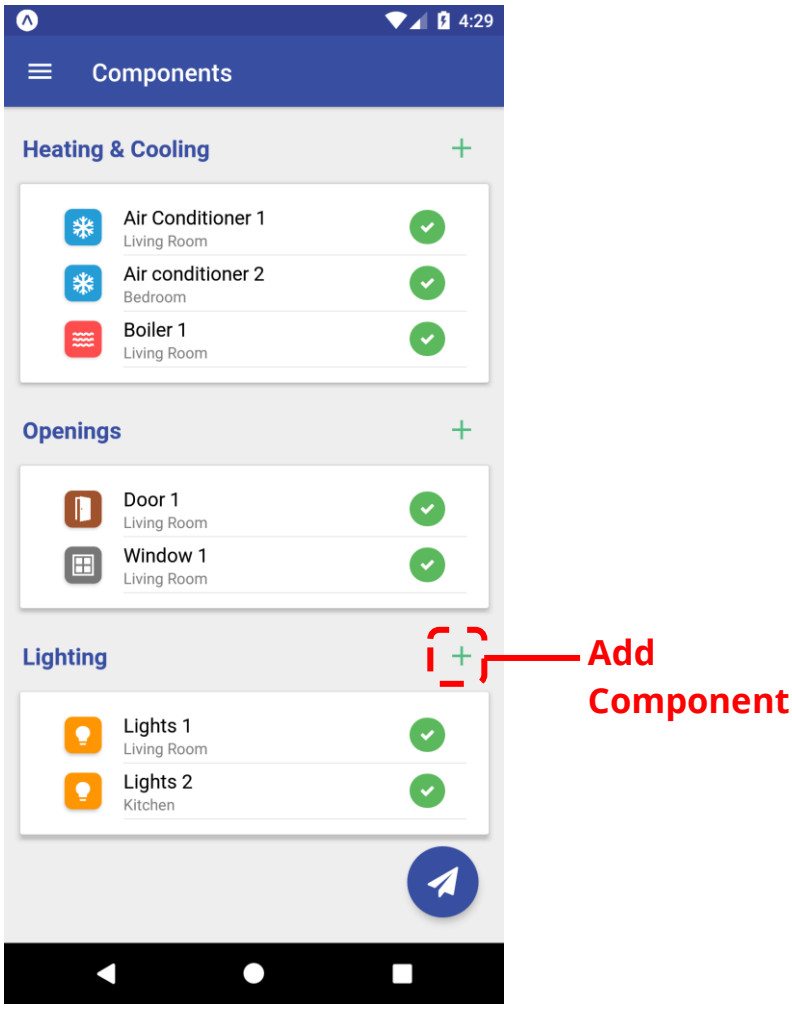

Figure 3-10: View all components in apartment

Once the users select to add a new component, they are directed to the "New Component" screen, where they are prompted to enter information about the component, such as the room it is placed, the component's name, type, manufacturer, model etc. (Figure 3-11).

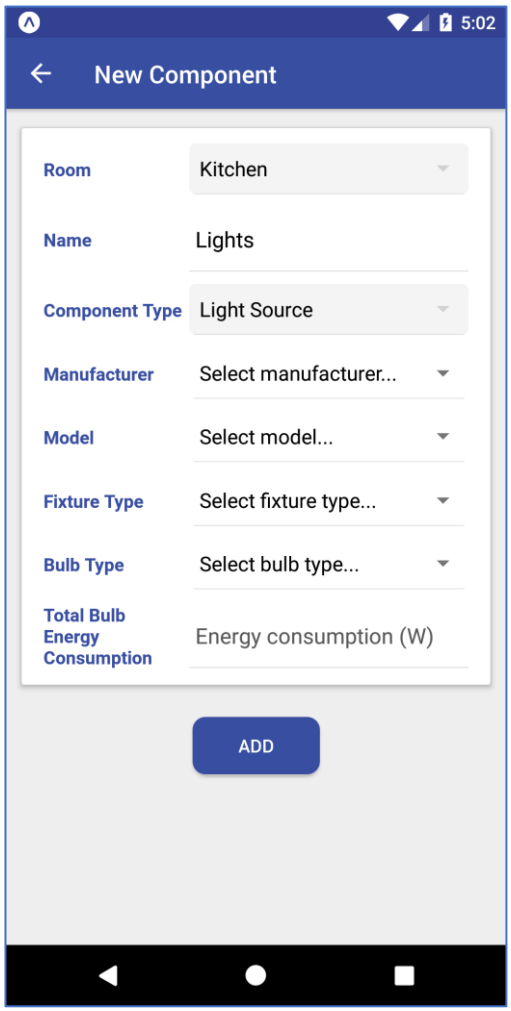

Figure 3-11: Add new component

If the users have tapped on a specific registered component, then they are directed to the component's page, where they can view the available information (Figure 3-12). They can click on the 'pencil' icon to add more details or edit the existing ones in the respective page (Figure 3-13), or click on the 'trashcan' icon and confirm to delete the component (Figure 3-14)

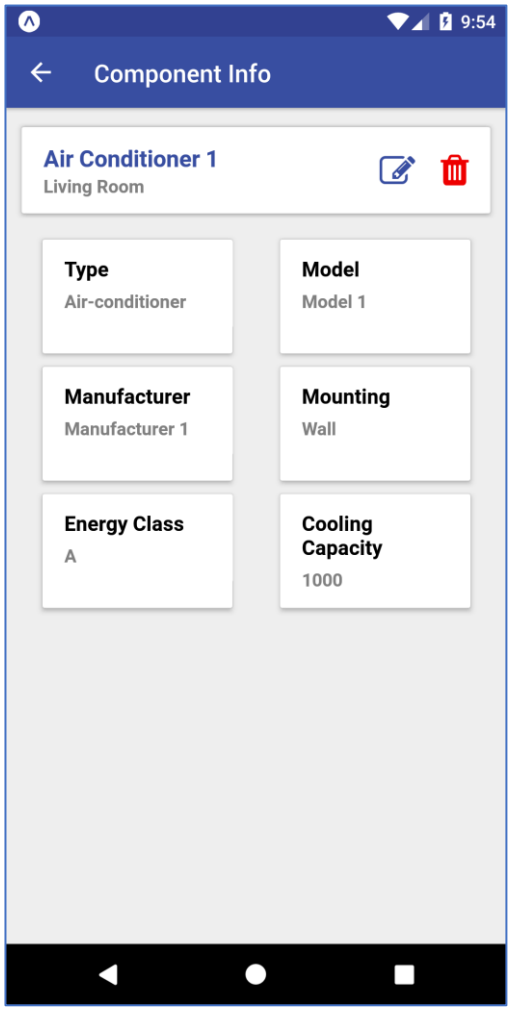

Figure 3-12: View component information

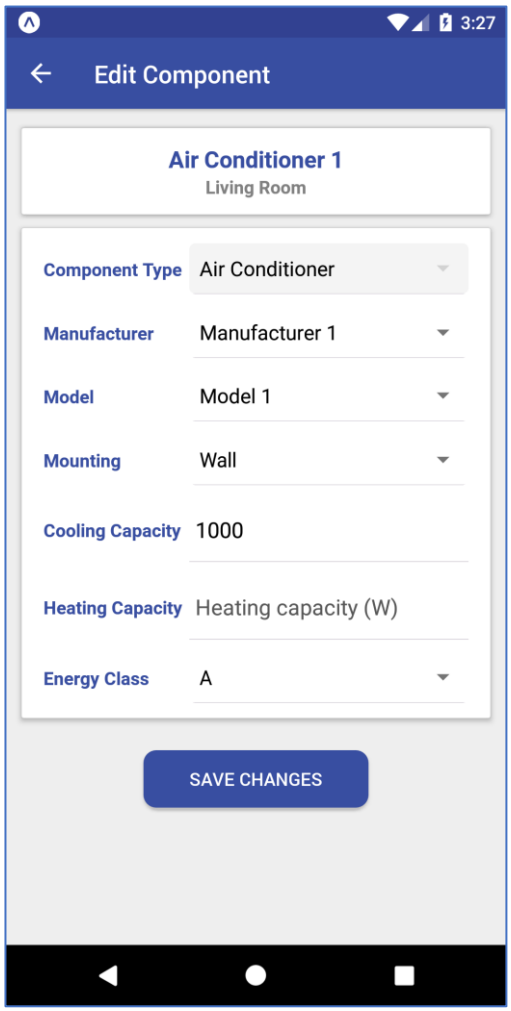

Figure 3-13: Edit component

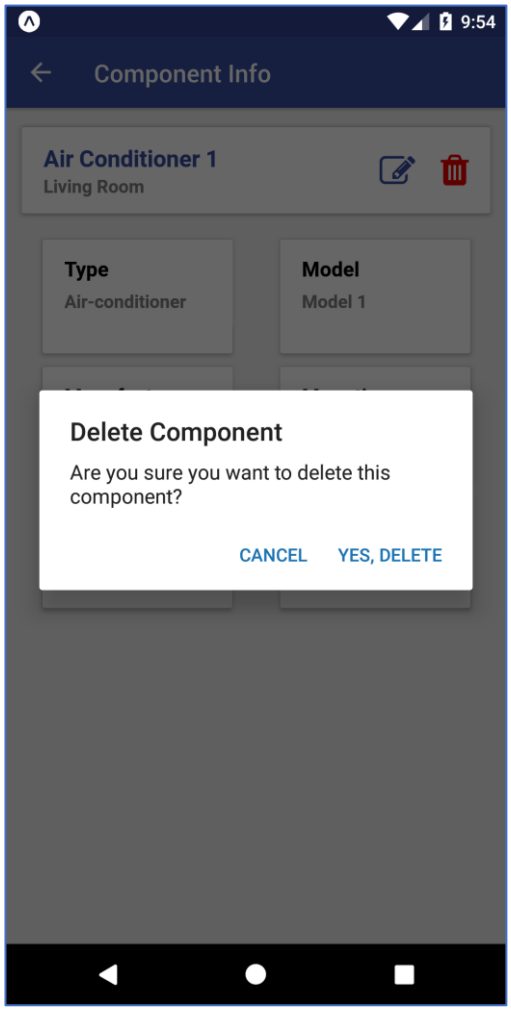

Figure 3-14: Confirm component deletion

3.6 REPORT ISSUE

By selecting the "Report Issue" icon form the Home page, the Main Menu, or any of the Rooms/Components pages, the users are directed to the "Report Issue" page, that includes a report form. If the users have been directed here from a generic page (i.e. Home, Main Menu, central Rooms page, central Components page), then the form is completely blank. Otherwise, if the users have selected to report an issue for a specific room or component, the respective fields of the form are preselected. The users can provide input in this form (except for the related room and component), the type of the issue (e.g. health & safety, maintenance etc.), free text description and attach a photo.

Once the users have completed the form with the available details, they can save and send the report through the BIF (Figure 3-15).

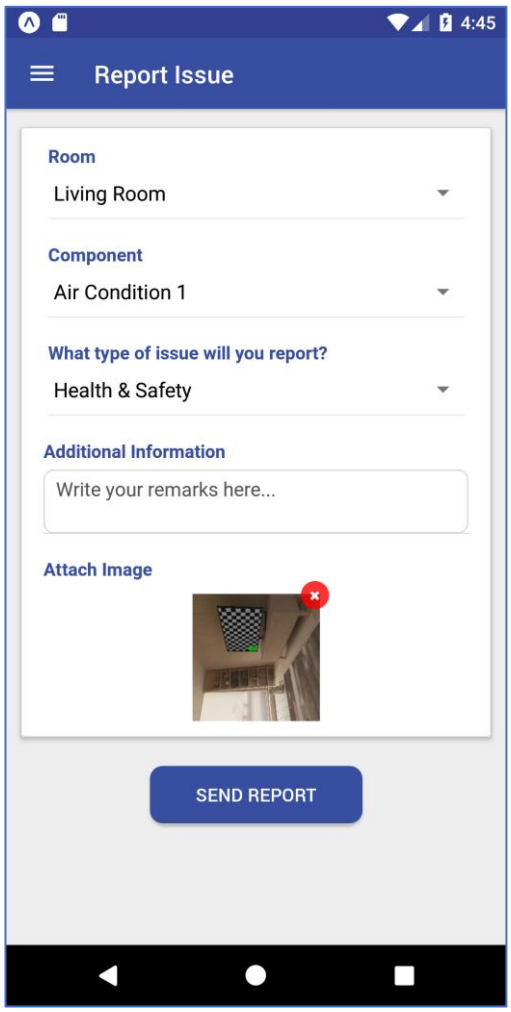

Figure 3-15: Send report

3.7 REPORT LOG

By clicking on the "Report Log" icon that is available in the Home page and the Main menu, the users can view a list of all the reported issues they have sent as well as any notifications about updates on them, along with some minimal information (timestamp, related room, related component) (Figure 3-16). The users can tap on any of the enlisted reports to view the full report's information in a dedicated page (Figure 3-17).

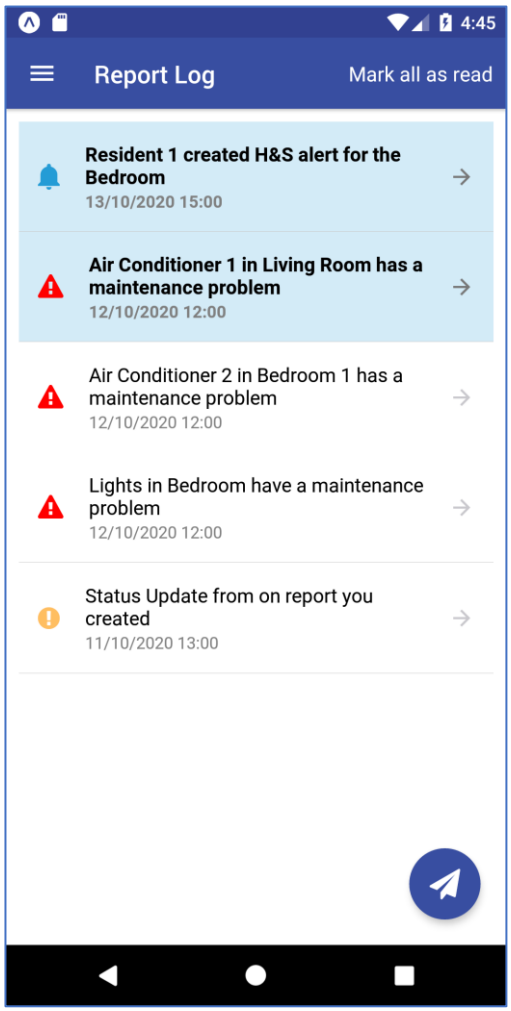

Figure 3-16: View report log

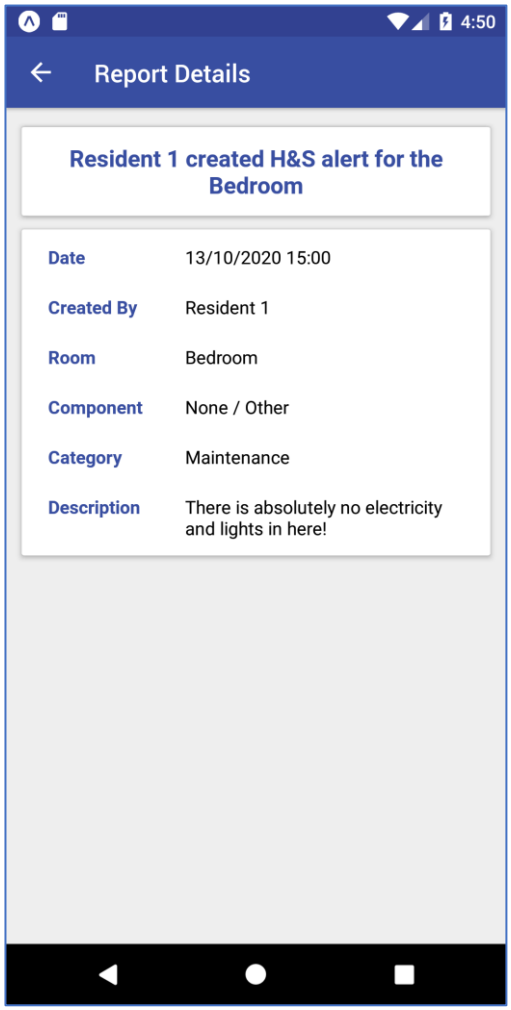

Figure 3-17: View report details

3.8 User Settings

Further to the above functionalities, a "User Settings" menu is provided, where residents (i.e. BICA users) can view and edit basic profile information (such as name, gender, age group, apartment occupancy number). Through this screen residents can also change their password (Figure 3-18 and Figure 3-19).

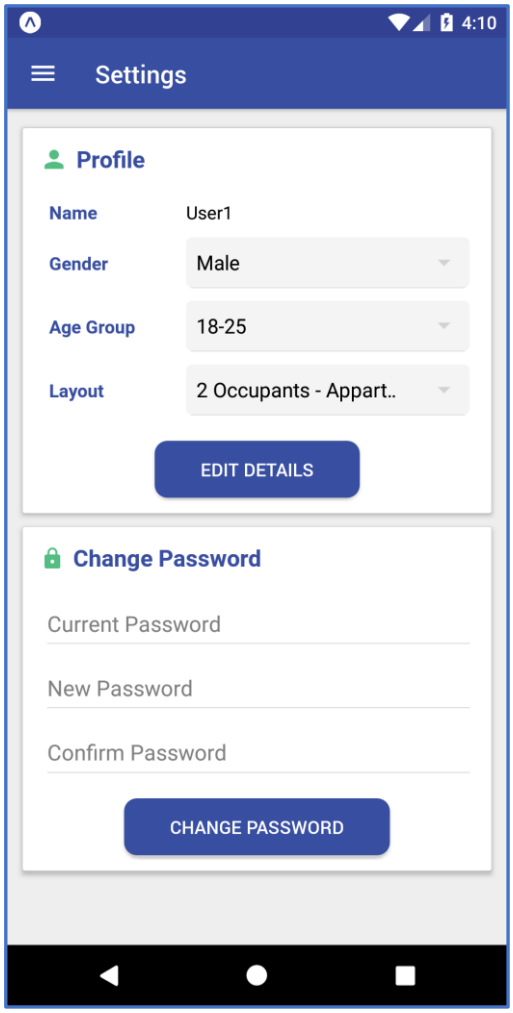

Figure 3-18: View user settings

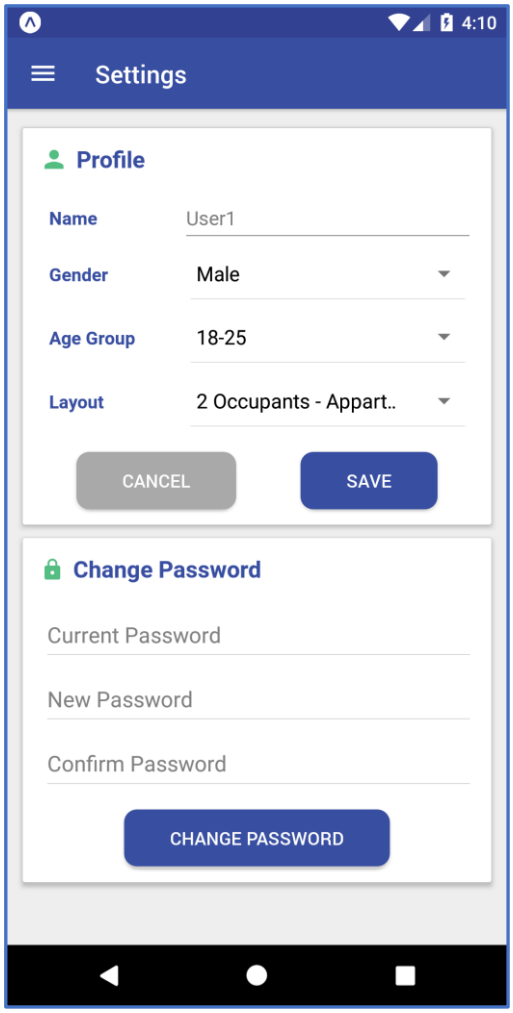

Figure 3-19: Edit user settings

4. CONCLUSIONS AND PLAN FOR 2ND ITERATION

The Building Information and Collection Application (BICA) documented in the present deliverable is one of the five main tools provided in the context of the digital building model creation toolkit delivered under the context of BIMERR WP5 "As-is Building Information Extraction & Model Population Tools". BICA provides the means for an accelerated collection of building-related data required for the initial renovation scenario modelling process with the contribution of the building residents. Through BICA, building residents can provide complementary information (such as notes and photos) to the already recorded building information, thus participating in the constant update of their building's pre-designed BIM model and as-built documentation. In addition, building residents can report any issues and faults related to their building, apartment, or specific equipment/components. Supplementary to the above and towards an increased information provision, the BICA application enables end users (i.e. building residents) to monitor near real-time conditions in their apartment and provide feedback on their comfort status against the set conditions.

The present deliverable provides a comprehensive overview and a documentation report of the first release of BICA along with the actual smartphone application that has been developed (as a standalone application for the first version) and delivered in accordance with the BIMERR requirements and architecture. As documented, the main functionalities of BICA provided to the building residents include:

- Visualization of room specific information of equipment and ambient conditions
- Building equipment management and information enhancement
- Projected comfort status visualization and actual comfort status reporting
- Reporting of issues related to an apartment and/or its equipment

Overall, this first version of the application can be used for testing at the different pilot sites of the BIMERR project. Additional enhancements and updates of the BICA app will be made available at the second version of this application, that will be integrated with the BIF and the Middleware's Identity provider and will incorporate the preliminary feedback received from the pre-validation sites. The second version will be delivered in

M30 of the project's implementation. Indicative features that will be provided in the final BICA release include:

(a) Integration with the BIMERR Interoperability Framework and other BIMERR applications and components, i.e. retrieval of data from the Materials & Components database will be possible through the BIF.
(b) Detailed apartment log, including alerts and notifications for issues reported from other residents in the same apartment, as well as status updates on the issues reported and connection to components – to the extent it is feasible.
(c) Customized configuration per component depending on its type.
(d) Integration of task management mechanisms.
(e) Integration of the final user registration workflow based on the final decision for apartment-residents mapping at BIMERR project-level.
(f) Request information from BICA users on-demand.
(g) Addition of feature to allow occupants to declare their room-usage information.

ANNEX I: BIBLIOGRAPHY

[1] BIMERR (2018) Description of Action (DoA)

[2] BIMERR (2019a) D3.1 - Stakeholder requirements for the BIMERR system

[3] BIMERR (2020a) D3.5 - BIMERR system architecture 1st version

[4] BIMERR (2020b) D3.6 - BIMERR system architecture final version

[5] BIMERR (2020a) D4.2 - BIMERR Ontology & Data Model [M15]

[6] BIMERR (2020a) D4.4 - BIMERR Building Semantic Modelling Tool 1

[7] BIMERR (2020a) D4.6 - BIMERR Information Collection & Enrichment Tool 1

[8] BIMERR (2020a) D4.8 - Integrated BIMERR Interoperability Framework 1

[9] BIMERR (2020b) D5.7 - Building resident energy-related behaviour profiling framework 1

[10] BIMERR (2020b) D6.4 - Adaptive workflow management & automation tool 1

[11] BIMERR (2020a) D7.1 - Populated Material/Component Database 1