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SOFTWARE TESTING AT CMED HEALTH LTD.

MD BORHAN SIDDIK



SOFTWARE TESTING AT CMED HEALTH LTD.

MD BORHAN SIDDIK

9

A project/report submitted
in partial fulfilment of the requirements
for the degree of
Bachelor of Science in Computer Science and Engineering

UNIVERSITY OF LIBERAL ARTS BANGLADESH
Dhaka, Bangladesh

April 2020

**1
DECLARATION**

I declare that this report/ project entitled “Software testing at CMED Health
⁵ Ltd.” is the result of my own research except as cited in the references. The report
/project has not been accepted for any degree and is not concurrently submitted in
candidature of any other degree.

Signature :

Name : MD BORHAN SIDDIK
ID : 151014024
Date : April 23, 2020

CERTIFICATE OF APPROVAL

The project report/ project entitled “*SOFTWARE TESTING AT CMED HEALTH LTD.*”⁶ is submitted to the Department of Computer Science and Engineering at University of Liberal Arts Bangladesh (ULAB) in partial fulfillment of the requirements for the degree of Bachelor of Science.

Dated: April 2020

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Professor & Head of Department

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University of Liberal Arts Bangladesh

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University of Liberal Arts Bangladesh

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DEDICATION

To my lovely parents, who gave me endless love, trust, constant encouragement over the years, and for their prayers.

To my mentors and peers for their patience, support, love, and for enduring the ups and downs during the completion of this thesis.

This report/thesis is dedicated to them.

ACKNOWLEDGEMENT

I wish to express my deepest appreciation to all those who helped me, in one way or another, to complete this project. First and foremost, I thank Almighty who provided me with strength, direction, and purpose throughout the project.

Special thanks to my supervisor Dr. Farhana Sarker for all her patience, guidance, and support during the execution of this project. Through her expert guidance, I was able to overcome all the obstacles that I encountered in these enduring three months of my project. In fact, she always gave me immense hope every time I consulted with her over problems relating to my project.

My sincere gratitude to the founder and chairman of CMED Health Ltd. Dr. Khondoker Abdullah Al Mamun for offering me to work at CMED in the first place and constantly guide and supervise my work on a weekly basis.

¹⁹
I am indebted to my industry supervisor Mr. Habibur Rahman for his directions, lessons, guidance and kind appreciation of my work. He was exceptionally helpful towards me in each situation at whatever point I confronted challenges.

And of course, all the employees and staff of CMED who were outstandingly friendly, co-operative, and supportive towards me throughout this whole time of my internship, I am grateful to all of them.

ABSTRACT

This report entitled '*Software testing at CMED Health Ltd.*' is a demonstration of the work and experiences I gathered from my three-month internship at my hosting company. The initial section of the report clarifies my intention for picking an internship over other choices as well as describes the duties and responsibilities I had undertaken to fulfill the requirements of the internship. In the next section, I portrayed the company background and details in a quick and accessible manner of a reader's perspective. In the last section of my report, I tried to cover the important aspects of my internship activities, the practical knowledge I have gained from the set of technologies while working in the software testing field. There I highlighted my work and responsibilities involving different projects like CMED Corporate Agent Mobile and Web Application, CMED User Application, and tools I have learned and used during this time which include two industry-level project trackers like Trello and Redmine and one of the leading API development tools like Swagger.

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LIST OF ABBREVIATIONS

CSE	7 Computer Science and Engineering
ULAB	University of Liberal Arts Bangladesh
Ltd.	Limited
REST	Representational State Transfer
API	Application Programming Interface
UI	User Interface
FDA	Food and Drug Administration
SPO2	Spot Oxygen Saturation
ICT	Information and Communications Technology
DGHS	Directorate General of Health Services
PKSF	Palli Karma Sahayak Foundation
HR	Human Resource
IT	Information Technology
CEO	Chief executive officer
R & D	Research and Development
COO	17 Chief Operating Officer
CMO	Chief marketing officer
CTO	Chief Technology Officer
AI	Artificial intelligence
IOT	Internet of Things
SDG	Sustainable Development Goals
USD	United States Dollar
GP	Grameenphone
AWS	22 Amazon Web Services
HTML	Hypertext Markup Language
CSS	Cascading Style Sheets
JS	JavaScript

CDN	Content delivery network
CRUD	Create, Read, Update and Delete
RSS	Rich Site Summary or Really Simple Syndication
APP	Application
QA	Quality Assurance
CSV	Comma-separated Values

CHAPTER 1

INTRODUCTION

An internship program is offered to the undergoing students of the graduate program as a bridge to the corporate world. Those who want to pursue a good career in an early life without running towards the poll of degrees, experience gained from an internship can help them jump start that career. Being a student at the University of Liberal Arts Bangladesh, we have the flexibility to choose the one that serves our best interest for our career development among thesis, project, and internship. Since my career goal was to enter the industry of engineering, I choose an internship over the other available choices. I was one of those lucky students who were recommended by the University to suitable companies and got the internship offer from CMED Health Ltd., a renowned software company in Bangladesh. I truly believe that my association at the company as an intern enriched my professional skills and ability to work in a dynamic environment and make an important impact in the field of software engineering.

1.1 Reason for choosing internship

The following are a few of the many reasons for choosing an internship at the start of my career development path

- i. Involvement in real-world problems: Working in a company environment, surrounded by other talented people, interacting with them to the approach for solving a real-world problem, and finding a solution

- for it, as a student, I can dive into all of these by working at an entry-level position like an internship.
- ii. Building connections: Internship frequently offers to attend meetings and conferences. By interacting with experts and professionals I will be able to build up a strong network of connections and learn how to communicate in an etiquette manner whenever I am in a professional environment.
 - iii. Ability to work in a team: In an office environment, every project becomes successful by the contribution of every single member of the assigned team. For a person to be able to communicate and co-operate with other team members, it is necessary to have such experience prior to his/her ability to work. By doing an internship and working in an office environment I will be able to learn teamwork and how it impacts the overall success ability of a project.
 - iv. Time management: Working under a tight schedule to meet the deadline of a project is often practiced in the professional environment. I will learn how to keep pace with time and work under stress while maintaining the quality of work.
 - v. Foundation for career development: Entry-level jobs like internships are the basic foundation of building a bright career. Since experience is overly viewed as the criteria for a good position in the industry, the internship will help me stock experience in my resume at the first stage of my career.

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1.2 Objectives of the report

The major objective of the report is to satisfy the partial requirement for my bachelor qualification in Computer Science and Engineering. This report depicts my internship experiences at CMED Health Ltd. where I accomplished practical work experience, learned a different set of technological tools used in a software development environment, and some company standards that are followed in software development companies.

1.3 Organization of the report

This report illustrates the outcomes from the beginning of the three months journey of my internship at CMED and describes all the work and experiences accumulated during the hour of my work. The report will be centered around my allotted undertakings and activities which are:

- i. Software testing of CMED Corporate Agent mobile/web application
- ii. Software testing of CMED User Application to ensure flawless data flow between Agent and User application
- iii. Create, read, update, delete user, and agent information using REST APIs from Swagger UI and ensure data matching and validation between backend and frontend
- iv. Collaborating with other testers to ensure the best quality by involving other projects.
- v. Testing of Corona Module Integration

One of the most challenging activities during this time was to work from home. Due to the Coronavirus pandemic, our office had to adapt the ability to operate online and continue to thrive in the concurrent situation. I have had the opportunity to experience and overcome this overwhelming challenge for over a month.

I tried my best to clarify each undertaking with as much subtleties as possible in a later chapter. This report is prepared uniquely for academic purposes to satisfy the necessity of the CSE degree program. It is also a small endeavor of my contribution to visualize the direct and indirect aspects of the software industry and their difficulties.

CHAPTER 2

COMPANY PROFILE

2.1 About CMED Health Ltd.

¹³ CMED Health Limited is a startup health-tech company concentrating on preventive healthcare established in 2016. CMED has a smart health observing framework for regular health monitoring. They utilize their FDA approved smart clinical sensors in association with smartphones for the estimation ³ of vital signs of people and store information to its secured cloud server. So, the individuals can benefit from their service effectively with a minimum effort and a very low cost. Additionally, the health records generated by the individual applications help the doctors reduce diagnostic time and provide better treatment.

2.2 ³ Vision

To create a world where everyone has access to preventive healthcare. [1]

2.3 Mission

The Mission at CMED is to accurately assess the vitals of people's health over time, in the environments where they live, work and play so they can reduce health risk, live more healthy & productive lives. Consequently, CMED will minimize peoples suffering & the overall mortality rate from noncommunicable diseases. [1]

2.4 Impact on Society

One of the greater things about CMED is their passion for serving people. Anyone can become a user at CMED and get a health account to digitally avail their services. Since the FDA approved smart devices only need a smartphone to operate, it is very easy for a user to measure his/her health vitals. Currently, CMED devices are capable of taking measurements for Weight, Height, ³ Blood Pressure, Pulse, Glucose in Blood, Oxygen Saturation (SPO2), Body Mass Index (BMI) ratio, Body Temperature. With the utilization of regular health monitoring systems, CMED is intended to minimize the risk of diseases like respiratory failure, heart attack, diabetes, hypertension, and so forth, thus reducing diagnostic time, hospitalization cost and other costs of facilities. Also, health account holders do not have to spend hours of time in hospitals and laboratories anymore.

2.5 Company Overview

The Following are at a glance about the company profile, their most prominent partner organizations, and the corporate clients that are currently benefiting from CMED services.

Table 2.1: CMED Health Ltd. company overview

Legal Name of the Company	CMED Health Ltd.
Slogan	Connecting People, Saving Lives
Logo	
Year of Establishment	2016
Legal Structure of the Company	Private Limited Company
Corporate Office	Apt# C-5, House# 761, Safura Green,

	Satmasjid Road, Dhanmondi, Dhaka-1209
Official Website	https://cmed.com.bd
Contact Email	info@cmedhealth.com
Contact Number	(+88) 017 42 92 5686
Founder & Chairman	Dr. Khondakar Abdullah Al Mamun
Managing Director	Dr. Farhana Sarker
Partner Organizations	ICT Division Bangladesh, DGHS, Grameenphone, United International University, PKSF, Diabetic Association of Bangladesh
Corporate Clients	United Group, Robi Axiata Limited, Grameenphone, Nahee Group, Res Group, Denim Asia Ltd., Bank Asia, Remex Corporation Ltd.

2.6 Department

Following major departments operates to run the business of CMED as per their technical and operational need.

- i. HR and Administration
- ii. Accounting and Finance
- iii. Sales and Marketing
- iv. IT and Technical

The overall structure of the company shown in an organogram bellow

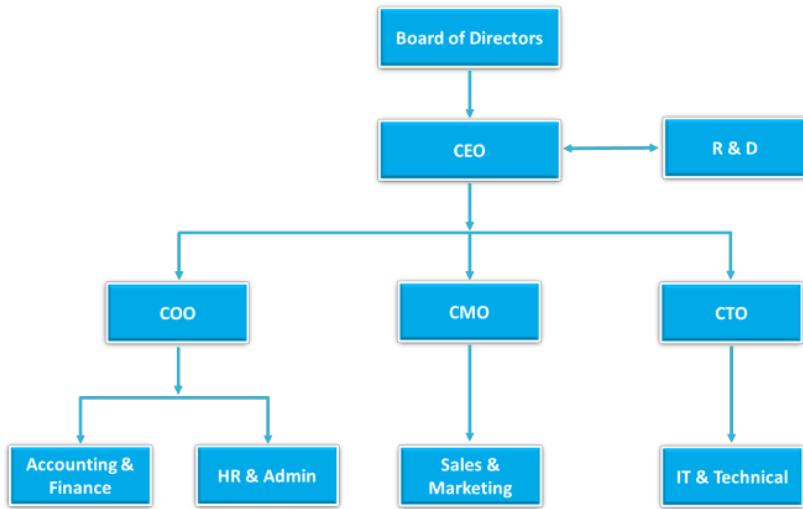


Figure 2.1: CMED company organogram

2.7 CMED Services

With the help of their AI-driven IoT enabled smart devices and clinical sensors CMED offers a wide variety of services and organizes programs for the betterment of the people.

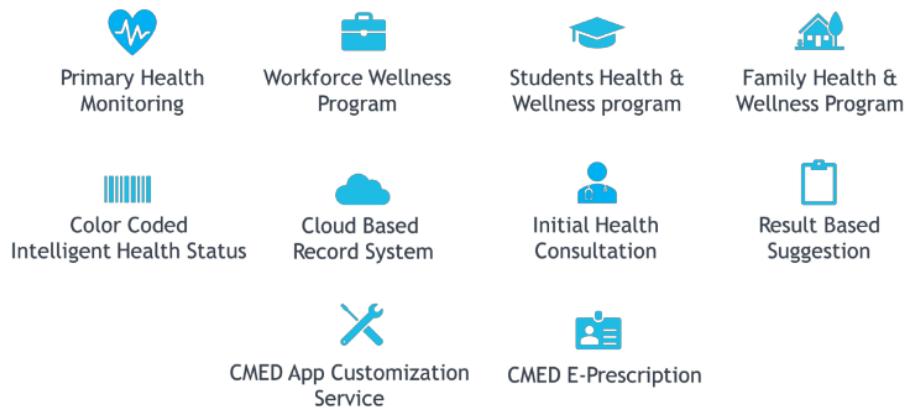


Figure 2.2: Services offered at CMED

These services often incorporate vital measurements and tracking health records that are simply accessed through their mobile applications.



Figure 2.3: CMED offerings with their services

2.8 CMED Products

CMED has an integrated eCommerce platform so that anyone can order and buy the measurement devices and measure vitals staying right at home. These products are offered individually and within a package to the buyers of different interests. Unlike other measurement devices, CMED devices do not require working internet to take measurements and save information locally. The only require Bluetooth connection to transmit data to the mobile device. Data is synchronized automatically when the mobile application gets online.

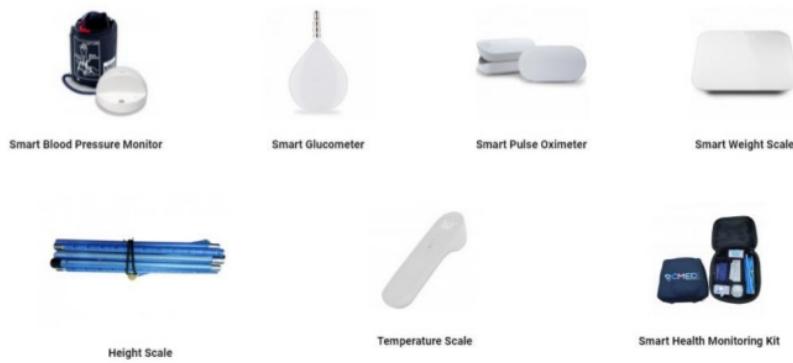


Figure 2.4: CMED Products

2.9 Project Management and Development Approach

For software development, there is no fixed and inbound method that is strictly followed at CMED. But it is very common practice at CMED to use the Model View View model (MVVC) design pattern for the development of their mobile applications. For project management activities like task assignment, tracking issues and bugs, suggesting features and enhancements and documenting instruction manuals they use project trackers like Redmine and Trello. For internal and office communication Slack is used all over the office and every member practices daily attendance and major announcement using the slack channels. For example, the team leaders of the respective team announce daily targets and collect reports at the end of the day.

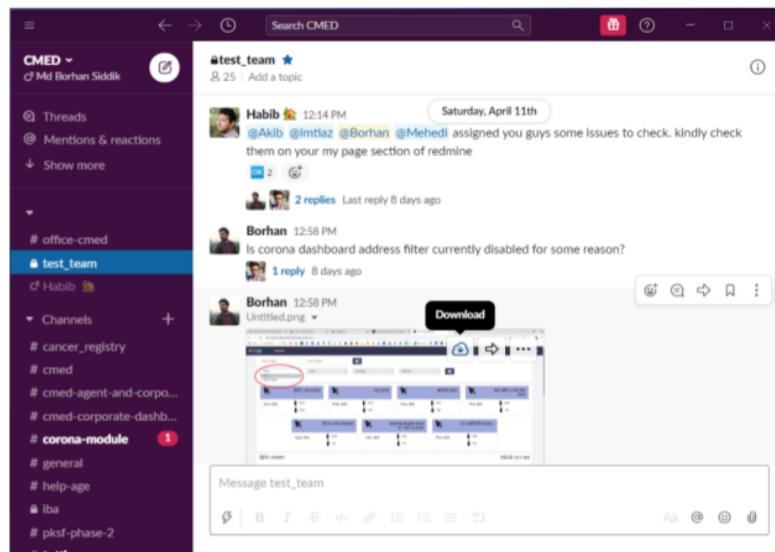


Figure 2.5: Daily target announcement via slack

The team members report back with their findings and issues of the day and set the priority of the tasks according to their importance.

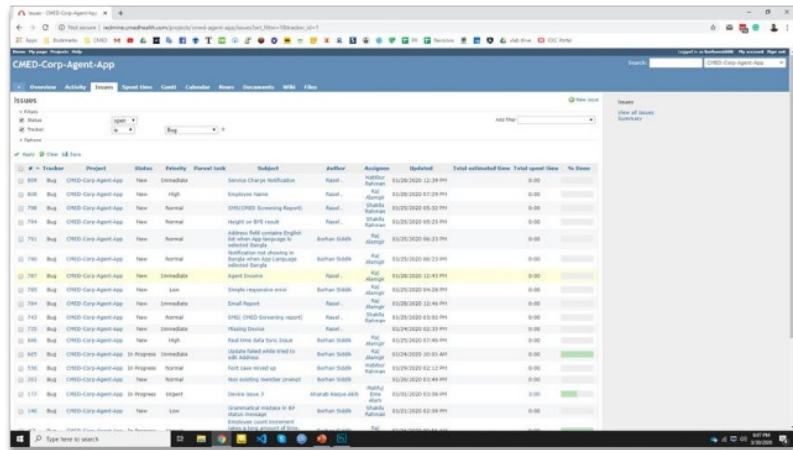


Figure 2.6: Team members reporting issues daily

2.10 Awards and Achievements

Within just 4 years of journey, CMED has already experienced wonderful recognitions and appraisal from the various national and international organizations and media coverage. Following are some achievements listed



Figure 2.7: CMED awards and achievements

- i. **SDG Inclusion in the Bangladesh Innovation Award 2018**
- ii. **Innovative Social Enterprise Award, Education in the DBS-NUS Social Venture Challenge Asia 2018**
- iii. **Seedstars Global Innovation Prize in Switzerland at 2018 Summit**

- iv. Innovation Award of BDT 10,00,000 funded by ICT ministry of Bangladesh.
- v. Received USD 10,000 FB startup package from Facebook.
- vi. 1st place at Seedstars Dhaka 2017
- vii. 1st place in the Basis National ICT awards 2017
- viii. Graduated from GP Accelerator Program

CHAPTER 3

WORKING PROJECTS

During my internship, I mainly worked as a software tester in the testing team under the quality assurance section of the technology department. From the very first week, I got assigned to the project named Corporate Agent Mobile (Android) and Web Application. This project was also connected to the CMED User application (Android) and therefore I had to ensure data transmission back and forth between these two applications is flawless and bug-free. Their relation to one another will be cleared later portion of this chapter. While testing these applications, if I had come across an issue or a software bug, it was significantly important to address it first and find out whether the frontend, the backend, or the app team was responsible for that.

3.1 Corporate Agent Mobile (Android) and Web Application

3.1.1 Project Background

Non-communicable diseases like heart attack, respiratory failure, diabetes, hypertension, heart attack, etc. usually remain unnoticed until any major health events. They are only diagnosed through routine health checkups. These diseases are very common to those people holding a job in the corporate field since they remain under stress for a long time and do not get much time for regular health checkups. So, most of the time these diseases grow up inside them and never get noticed until their condition becomes severe.

CMED addressed this problem and took an approach to regular checkup and monitor these employees in a way that they do not waste their valuable time in hospitals and diagnostic centers yet staying under constant supervision of a health monitoring system that can identify such health issues as soon as they start to show up symptoms. Corporate agent mobile and web applications were developed for this purpose. Registered companies can monitor their employees' health from office on a weekly or monthly basis. The mobile application can take vital measurements of a group of employees under the selected agents who are responsible to take their measurements. Agent application can be connected to all the CMED smart health monitoring devices and whenever a measurement is taken it directly goes through the mobile application and saves that information to CMED could server for the respective employee. It works both online and offline. Offline measurements are synchronized automatically when the device gets an internet connection. All the measurement devices can be connected via Bluetooth with a tap of a finger. A report can be generated and emailed to the employees' given email address.

A super admin of the agents who is the parent admin can access, view, and monitor all the statistical health data of the employees of that company using certain filters from the web dashboard.

3.1.2 Technologies Used

To store health information collected by the agent application, one of the most popular cloud servers, Amazon AWS server is used along with the staging versions hosted on Firebase.

Corporate Agent Mobile Application:

- i. Kotlin programing language
- ii. Android Jetpack Library
- iii. MySQL Database
- iv. IntelliJ IDEA

Corporate Web Dashboard / Application

- i. HTML, CSS, TypeScript
- ii. Bootstrap CSS Framework
- iii. Angular, Moment JS JavaScript Framework
- iv. Firebase and Cloudflare CDN

3.1.3 Project Design

At CMED the design team is responsible to frame the structure of the idea when it is generated. The final product of a mockup or a design frame is the user interface of every application developed at the company. The Design team takes the idea from the requirements analysis, create design templates using tools like Adobe XD, and pass to the developers for further development.

Figure 3.1 illustrates an agent login page, a registration page that is used to register an employee, and a home page that shows the total number of employees/members of the company and the total number of services the agent has served already.

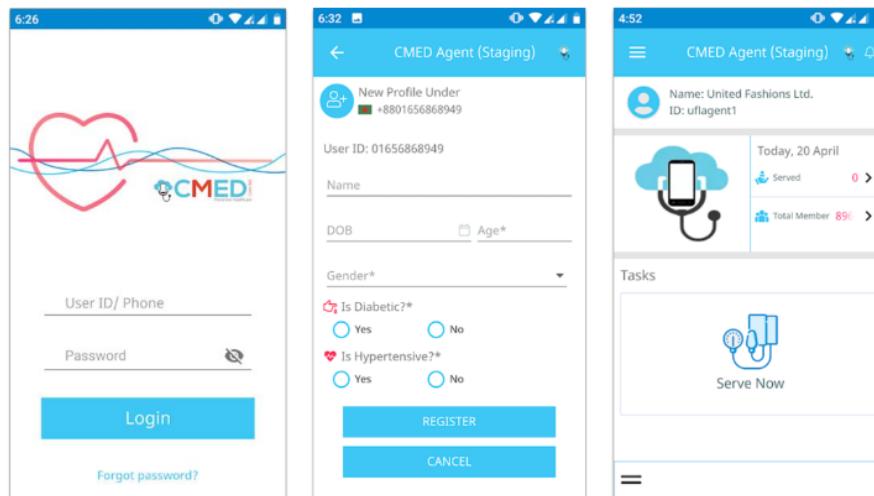


Figure 3.1: Agent login page, registration page, dashboard

Figure 3.2 illustrates a measurement page for a certain employee, a connection page that appears when connecting to a CMED smart device, and a measurement status page that appears after a measurement is successfully taken.

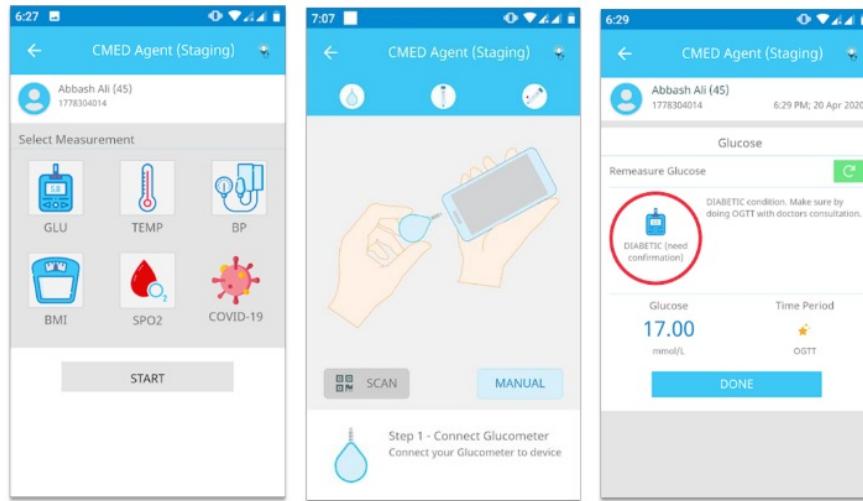


Figure 3.2: Measurement page, device connection page, measurement status page

Figure 3.3 describes the homepage of the dashboard after login with a super admin of the company. Health reports from the agent application are statistically shown here in different sections of the dashboard.

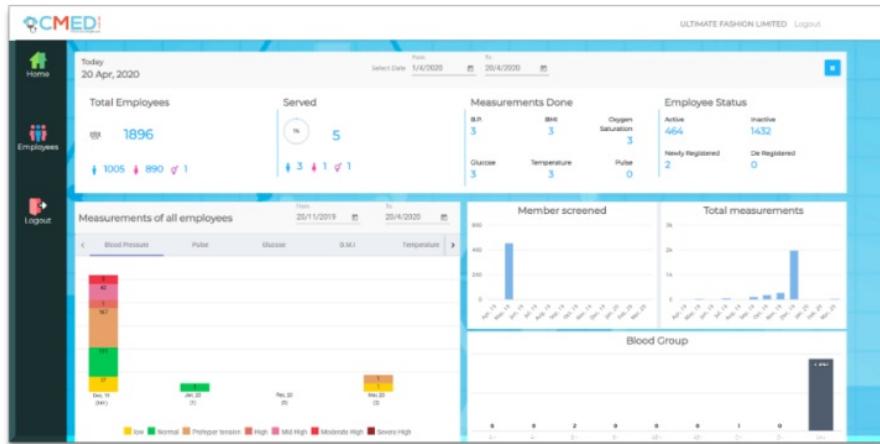


Figure 3.3: Corporate dashboard home page

A List of all the employees can be viewed, filtered and managed from this page. Super admin even can register new employees here.

The screenshot shows a web-based application interface for managing employees. The top navigation bar includes links for Home, Employees, and Logout. A search bar at the top allows filtering by Name, Emplyoee ID, or Mobile number. Below the search bar, a message says "Showing all the employee list below". The main content area is a table with the following data:

Name	Employee ID	Mobile Number	Unit	Department	Job Title	Last Measured
Almas Arjum	188	+919110111808				Mar 22, 2020
Aamina Khanum	105223	1092670585				Jan 14, 2020
Beauty Begum	105930	1059844610				Jan 14, 2020
Beauty Akter	105845	1091673247				Jan 14, 2020
Emran	105945	1052144986				Jan 14, 2020
Haseen Ali Mamun	105839	1056032064				Jan 14, 2020
Hasan Ahmed	104487	1024746772				Jan 14, 2020
Hosneera	105276	0176049503				Quality Inspector
Samail Hossain	105623	0175910894				Jan 14, 2020
Saeed Mia	105933	1054544842				Gen. Operator
Koko Bowman	10	+8803707624058				Jan 14, 2020
Masud Mia	105620	10739322054				Asst. Packing Man
Minaara Khanum	105633	1052739964				Mar 22, 2020
Mohammed	105634	10604238698				Jan 14, 2020
Muniruzz Islam	105635	1050853326				Jan 14, 2020
Muzammil Khan	105636	1052144986				Line Worker
Monzurul Kader	105637	1052144986				Jan 14, 2020

Figure 3.4: Employee list of a company

3.1.4 Connection with CMED User Application

The Corporate Agent app is directly connected to the other application, CMED User app. Perhaps the user application was developed in the first place to monitor the health vitals of normal users. Later it was combined with the agent app so that the measurement taken by the agents would directly and instantly reflect to the corresponding account of the employee. This way the employee can always monitor his/her vitals and share and download reports for further prescriptions from the doctors.

Figure 3.5 describes the measurement taken by the agent from the agent application is flowing in real-time to the employee's account on the user application.

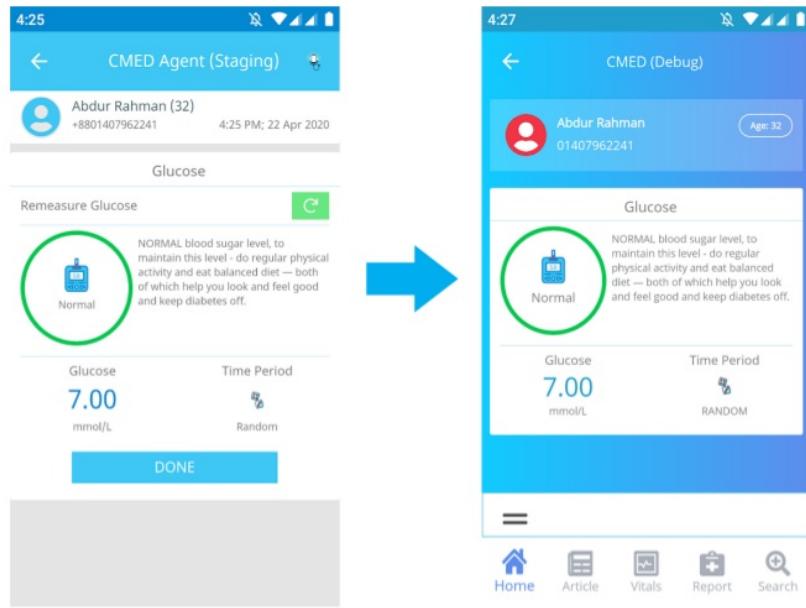


Figure 3.5: Data flow from agent to user app

CHAPTER 4

INTERNSHIP ACTIVIES

My internship activities required the knowledge of software testing, how it can benefit the development of software products, how many ways software testing can be done etc. By joining the test team, I began to learn about the practices of software testing that are followed in my hosting company under the guidance of my supervisor and other testers.

Based on the progression I made, my supervisor involved me in software testing of the Corporate Agent mobile application in the first place. Seeing my enthusiasm and capacity to work more, I was asked to take the responsibility of testing the whole project. Therefore, Corporate Dashboard (web application) and CMED User application also became part of my testing ground. During the testing of these applications, I was facing problems finding the source of a bug like data mismatch between agent mobile application, web dashboard, or user application. Since it was necessary to find out the source of an error in data, I was introduced to the backend APIs using Swagger User Interface. The backend developers helped me how to perform CRUD operations on agent and user accounts or import a list of large data set all at once through these APIs.

4.1 Software Testing¹²

In basic terms, Software Testing implies the Verification of Application Under Test (AUT). It is a procedure that can be used to assess the functionality and evaluate the usefulness of a software product with an intention to find whether the developed

program met predefined requirements or not and to identify the deformities to guarantee the flawless quality of the product.

4.1.1 Types of Software Testing

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In general, software testing can be of two types

- i. Manual Testing
- ii. Automation Testing

2 4.1.1.1 Manual Testing

Manual testing is the process of testing software by hand to learn more about it, to find what is and isn't working. This usually includes verifying all the features specified in requirements documents, but often also includes the testers trying the software with the perspective of their end user's in mind. Manual test plans vary from fully scripted test cases, giving testers detailed steps and expected results, through to high-level guides that steer exploratory testing sessions. [2]

2 4.1.1.2 Automation Testing

Automation Testing: Automation testing is the process of testing the software using an automation tool to find the defects. In this process, testers execute the test scripts and generate the test results automatically by using automation tools. [2]

4.1.2 Software Testing Approaches

There are three software testing approaches:

- i. White Box Testing
- ii. Black Box Testing
- iii. Gray Box Testing

8

4.1.2.1 White Box Testing

4

White box testing goes by other names like Clear Box, Glass Box, and Structural Testing. White Box Testing depends on the application's interior code structure. In white-box testing, an inner point of view of the framework, as well as programming skills, are utilized to design test cases. This testing is generally done at the unit level.

15

4.1.2.2 Black Box Testing

Black box testing is a method that disregards the internal mechanism or structure of the code and focuses on the output generated against the output and evaluates the functionality of the software under the test.

8

4.1.2.3 Gray Box Testing

2

Gray box testing is the blend of both white and black box testing. The tester needs to have access to the design documents to create better test cases.

4.2 Software testing of CMED Applications

Since manual testing is encouraged at CMED, in my projects I mostly followed manual testing in a black box testing approach. According to software testing fundamentals, 100% automation is not possible and there is always a necessity left for user acceptance, accessibility, and satisfaction which leads to human interaction in the time of testing. Manual testing recognizes the bugs and issues as well as the inconveniences a user can possibly experience while using the application or software. This way developers are able to resolve most of the software defects and irregularities even before launching the final product in the market.

4.2.1 Documentation of Test Cases

At the first stage of my testing, I used to make detailed documentation of the test cases in a spreadsheet. This was useful not only for other testers and developers to quickly learn about the application but also to recheck all the scenarios every time they resolve some issues and release a staging build for testing. These test documents would often include test categories, test scenarios, steps to check the case, expected results, actual results, and pass/fail status of the case. After properly documenting the cases I would execute them and change their status by matching the actual results with the expected results. According to the status of the case, developers would take further initiatives for the betterment of the program.

Test Cases for Corporate Agent								
File Edit View Insert Format Data Tools Help All changes saved in Drive								
	A	B	C	D	E	F	G	H
1	Project Name:	CMED Agent App	Designed by:	Md Borhan Siddik				
2	Platform:	Android	Designed date:	28.01.2020				
3	Release Version:	1.0.0.0	Executed by:	Md Borhan Siddik				
4			Execution date:	02.02.2020				
5								
6	Category	Sub Category	Test Case Scenario	Test Steps	Expected Results	Actual Results	Status	Issue & Suggestions
7	Login Check	Valid Credential	Check Login with correct user id and password	# Enter Correct user id and password # Click login	User should be able to login successfully	Login was successful	Pass	
8		Invalid Credential	Check Login with invalid user id and password	# Enter invalid user id and password # Click login	Login should fail. Error message should come up.	As Expected	Pass	
9			Check Login attempt with empty fields	# Keep the fields empty # Click login	Login should fail. Error message should come up.	As Expected	Pass	
10	Dashboard Check	Agent Credential	Check if agent Name and id are displaying correctly	# Go to dashboard # Click agent name and id	Agent credentials must be correct	As Expected	Pass	
11		Company Credential	Check if Company Name displaying correctly	# Click on the burger menu # Click on the burger menu	Company credentials must be correct	As Expected	Pass	
12			Check if Employee number is displaying correctly	# Click on the burger menu # Click on the burger menu	Number of employee should be correct	Number of employee is not correct	Fail	Employee Count doesn't match.
13			Check number of served is showing correctly	# Click on the burger menu # Click on the burger menu	Number of served times should be correct	As Expected	Pass	
14	Date		Check if the date is showing correctly	# Click on the burger menu # Click on the burger menu	Date should be the present day	As Expected	Pass	
15	Agent Profile	Agent Credential	Check if agent Name and id are displaying correctly	# Click on the burger menu # Click on the burger menu	Agent credentials must be correct	As Expected	Pass	
16		Agent Image	Check if agent image is showing correctly and can upload while clicked	# Click on the burger menu # Click on the burger menu	Should show agent image on profile page	Not implemented yet	Not Yet Implemented	Need to implement profile image
17				# Click on the burger menu # Click on the burger menu				Fail

Figure 4.1: Test cases written for initial functionalities

Test Cases for Corporate Agent								
File Edit View Insert Format Data Tools Help LastEditLastEdit.html								
	A	B	C	D	E	F	G	H
1	Project Name:	CMED Agent App	Designed by:	Md Borhan Siddik				
2	Platform:	Android	Designed date:	28.01.2020				
3	Release Version:	1.0.0.0	Executed by:	Md Borhan Siddik				
4			Execution date:	02.02.2020				
5	Category	Sub Category	Test Case Scenario	Test Steps	Expected Results	Actual Results	Status	Issue & Suggestions
6	Employees	Employee count	Check if Employee number is displaying correctly in all categories	# From Dashboard click on Employees # Click on the number of employees in all categories	Number of employees should be correct in all categories	As Expected	Pass	
7	Serve Now	Search employee to serve	Check if search function working properly	# From dashboard go to serve now # input credatable number in search bar	Corresponding employee should appear in search list when searched with credatable mobile number	As Expected	Pass	
8		Create new user	Check if you are able to create new user profile if the input mobile number did not appear in search list	# From dashboard go to serve now # input mobile number in search	New user should be created	As Expected	Pass	
9				# Click on create new user profile with # Enter details in the fields # Click on register				
10	Measurement List		Check if the measurement list is showing correctly	# From dashboard # Select the measurement list	Should show correct measurement list	Measurement list is showing but there is some language mismatch	Fail	
11	Blood Pressure	With Device	Check if user can take BP measurement with Device	# Go to dashboard # Select Serve Now # Select Measurement # Click on a member # Select Measurement # Select Finished	User is able to connect to device and take measurement successfully, measurement status is shown	As Expected	Pass	
12		Manually	Check if user can take BP measurement manually	# Go to dashboard # Select Serve Now # Search Employee # Click on a member # Enter Measurement # Save/ Present	Manual data is added and status is shown	As Expected	Pass	

Figure 4.2: Test cases written for measurement functionalities

4.2.2 Utilization of Project Trackers

Documenting and executing test cases was beneficial for full checking of every release but it is a slow process that requires much patience. In this scenario, urgent issues like blockers and other high priority bugs that need immediate action cannot be resolved in an efficient manner. CMED uses other alternatives like project trackers that can be used to address issues in a much faster and effective way and track the projects under development. I also had to adapt the two famous project trackers that the company use; Trello and Redmine.

4.2.2.1 Software Testing with Trello

Trello is a simple easy to use project tracker which has an attractive graphical interface and can be used to track ideas, plans, and issues in a flexible way. Projects can be traced under a list of cards that are stacked one after another and organized inside a board. I used Trello to list bugs and issues under their respective project boards and mark them with the color level according to their priority. There were lists of New Issues, Refactoring Issues, Issues in Development, Ready for Testing, Closed, Reopened, etc. When I found a new bug, it would go to the New Issues list and then developers would address and move them to In Development and when done fixing they would send back to Ready for Testing list. I would close them if they were fixed or send them back to reopen if persist.

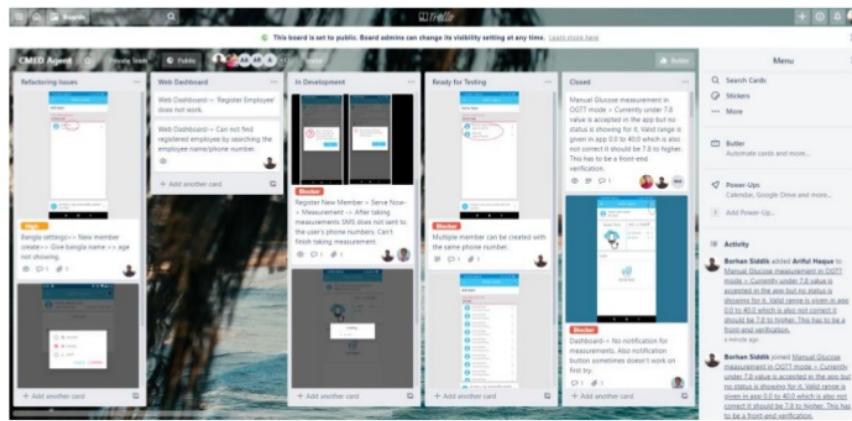


Figure 4.3: Issue tracking with Trello

4.2.2.2 Software Testing with Redmine

Redmine is another popular open-source, cross-platform project management tool widely used by the developers and software engineers all over the world.

Some of the main features of Redmine include

- i. Multiple project supports
- ii. Flexible issue tracking system
- iii. Flexible role-based access control
- iv. Calendar and grant chart
- v. Integrated documents and file management system
- vi. RSS feeds and email notifications
- vii. Issue creation via emails
- viii. Time tracking of projects

CMED utilizes Redmine for project and issue tracking. From the planning of a project, documenting requirement specifications, tracking bugs and issues, suggesting new features and improvements, etc. all are done through this project management tool. Compare to Trello, Redmine does not have a very likable user interface, yet it is enriched with powerful features that make it such a wonderful project tracker. Although it took me a couple of days to learn and be comfortable with this new tool, it was completely worthy of my time.

Whenever I used to create a new issue like addressing a bug, suggesting a new feature or enhancement, I would create under the respective projects assigned to me. The following page in Redmine named ‘My Page’ contains all the issues I used to report on a daily basis as well as the issues that were assigned to me to ready for testing.

The screenshot shows the Redmine 'My page' interface with two main sections:

- Issues assigned to me (11)**: A table listing issues assigned to the user. The columns are: #, Project, Tracker, Status, and Subject. The data includes:

#	Project	Tracker	Status	Subject
1017	CMED-Corp-Web	Bug	Ready for Testing	Force logout again
1040	CMED-Corp-Agent-App	Bug	Ready for Testing	Error in registration when sync fail (normal agents)
63	CMED-Corp-Agent-App	Bug	Ready for Testing	Employee count increment takes a long amount of time. Sometimes count is not shown in dashboard
947	CMED-Corp-Agent-App	Bug	Ready for Testing	Employee count increment takes a long amount of time. Sometimes count is not shown in dashboard
483	CMED-Corp-Web	Bug	Ready for Testing	Upgrading address field is affecting user credentials
684	CMED-Corp-Agent-App	Bug	Ready for Testing	Real time data sync issue
753	CMED-Corp-Web	Bug	Ready for Testing	Blood Group Selection
754	CMED-Corp-Web	Bug	Ready for Testing	Employee count increment takes a long amount of time
939	CMED-Corp-Agent-App	Bug	Ready for Testing	No status message and BH ratio
1033	CMED-User-App	Bug	Ready for Testing	Simple responsive issue on registration page
- Reported Issues (55)**: A table listing issues reported by the user. The columns are: #, Project, Tracker, Status, and Subject. The data includes:

#	Project	Tracker	Status	Subject
1032	CMED-User-Apps	Bug	Ready for Testing	Simple responsive issue on registration page
1042	CMED-Corp-Agent-App	Bug	Ready for Testing	Error in registration when sync fail (normal agents)
916	CMED-Corp-Agent-App	Bug	Ready for Testing	No status message and BH ratio
947	CMED-Corp-Agent-App	Bug	Ready for Testing	Service details count error for JRF logic
1041	CMED-Corp-Agent-App	Bug	Ready for Testing	Employee count increment takes a long amount of time
753	CMED-Corp-Web	Bug	Ready for Testing	Blood Group selection
757	CMED-Corp-Web	Feature	Ready for Testing	Company Logo is Missing
1017	CMED-Corp-Web	Bug	Ready for Testing	Force logout again
63	CMED-Corp-Agent-App	Bug	Ready for Testing	Employee count increment takes a long amount of time
886	CMED-Corp-Agent-App	Bug	Ready for Testing	Real time data sync issue

Figure 4.4: ‘My Page’ containing reported and assigned issues

Issues										
<input type="checkbox"/> Filters <input checked="" type="checkbox"/> Status <input checked="" type="checkbox"/> Tracker <input checked="" type="checkbox"/> Author <input type="checkbox"/> Options										
#	Project	Status	Priority	Parent task	Subject	Author	Assignee	Updated	Total estimated time	% Done
1092	Bug CMED-Corp-Agent-App	New	High		Problem with rounded age value after decimal point	Borhan Siddik	Sayem Hossain	04/21/2020 06:15 PM	0:00	
1088	Bug CMED-Corp-Agent-App	In Progress	Immediate		Measurement validation error	Borhan Siddik	Sayem Hossain	04/20/2020 06:18 PM	1:00	
1080	Bug CMED-Corp-Agent-App	New	High		Email was thrown because of grammar	Borhan Siddik	Sayem Hossain	04/21/2020 06:23 PM	0:00	
790	Bug CMED-Corp-Agent-App	New	Normal		Measurement not showing in dashboard when App Language switched to English	Borhan Siddik	Ashraf Dawood	04/11/2020 06:30 PM	0:20	
556	Bug CMED-Corp-Agent-App	In Progress	Normal		First date picked up from awaiting measurement prompt	Borhan Siddik	Sayem Hossain	04/01/2020 02:47 PM	0:00	
203	Bug CMED-Corp-Agent-App	New	Normal		Measurement prompt	Borhan Siddik		04/24/2020 03:49 PM	0:00	
140	Bug CMED-Corp-Agent-App	New	Low		Grammatical mistake in SF message	Borhan Siddik	Ashraf Dawood	04/05/2020 01:18 PM	0:00	
59	Bug CMED-Corp-Agent-App	New	Low		Grammatical mistake in SF status message	Borhan Siddik	Shihab Hossain	04/01/2020 01:22 PM	0:00	

Figure 4.5: Example of issues reported for Agent App

Issues										
<input type="checkbox"/> Filters <input type="checkbox"/> Options										
#	Project	Status	Priority	Parent task	Subject	Author	Assignee	Updated	Total estimated time	% Done
1044	Bug CMED-Corp-Web	New	Immediate		Data miss-match between web and back-end	Borhan Siddik	Sayem Hossain	04/21/2020 06:57 PM	0:00	
945	Bug CMED-Corp-Web	New	Immediate		'Measurements of all employees' is missing from section that is selected on 'To Date'	Borhan Siddik	Ashraf Dawood	04/11/2020 11:17 AM	0:00	
873	Bug CMED-Corp-Web	New	High		Whatever data range is selected from February 2020 measurement done staying the same	Borhan Siddik	Sayem Hossain	04/05/2020 07:01 PM	0:00	
821	Bug CMED-Corp-Web	New	Normal		Invalid error message on login attempt	Borhan Siddik	Sayem Hossain	03/31/2020 11:14 AM	0:00	
758	Bug CMED-Corp-Web	QA Verified	Low		Mobile number field placeholder	Borhan Siddik		03/25/2020 08:15 PM	0:06	
754	Bug CMED-Corp-Web	New	Normal		Measurements Done will include SPO2	Borhan Siddik	Shihab Hossain	03/25/2020 06:32 PM	0:00	
751	Bug CMED-Corp-Web	In Progress	Normal		Employee Status field section Registration form does not have 'Age' field for DOB	Borhan Siddik	Sayem Hossain	03/31/2020 11:11 AM	0:30	
738	Bug CMED-Corp-Web	New	Normal			Borhan Siddik	Moinul Chowdhury	04/11/2020 06:32 PM	0:00	

Figure 4.6: Example of issues reported for Corporate Web

CMED-User-App													
Overview Activity Issues Spent time Gantt Calendar News Documents Wiki Files													
ISSUES													
Filters Options													
<input checked="" type="checkbox"/> Apply <input type="button" value="Clear"/> <input type="button" value="Save"/>													
		Tracker	Project	Status	Priority	Parent task	Subject	Author	Assignee	Updated	Total estimated time	Total spent time	% Done
1038	Bug	CMED-User-App	Closed	High			“ সংগৃহীত করুন স্বাক্ষর ” button does not work	Borhan Siddik	Habibur Rahman	04/15/2020 11:56 AM	0:00		
1033	Bug	CMED-User-App	Closed	Normal			Simple responsive issue on registration page	Borhan Siddik	Habibur Rahman	04/21/2020 11:18 PM	0:30	<div style="width: 100%;"><div style="width: 100%; background-color: #99ff99;"></div></div>	
1031	Bug	CMED-User-App	Closed	Normal			No indicator for Country code	Borhan Siddik	Habibur Rahman	04/12/2020 10:35 AM	0:30	<div style="width: 100%;"><div style="width: 100%; background-color: #99ff99;"></div></div>	
648	Bug	CMED-User-App	Closed	Normal			Update failed Issue	Borhan Siddik	Habibur Rahman	04/05/2020 11:23 AM	1:00	<div style="width: 100%;"><div style="width: 100%; background-color: #99ff99;"></div></div>	
647	Bug	CMED-User-App	Closed	Normal			Auto closing Historical Info	Borhan Siddik	Habibur Rahman	03/24/2020 12:25 PM	0:40	<div style="width: 100%;"><div style="width: 100%; background-color: #99ff99;"></div></div>	
646	Bug	CMED-User-App	Closed	Urgent			Could not register when filled additional information	Borhan Siddik	Habibur Rahman	04/05/2020 11:23 AM	1:00	<div style="width: 100%;"><div style="width: 100%; background-color: #99ff99;"></div></div>	
643	Bug	CMED-User-App	Closed	Immediate			If update fails somehow, every values about user becomes either N/A or blank	Borhan Siddik	Habibur Rahman	03/24/2020 12:25 PM	0:00	<div style="width: 100%;"><div style="width: 100%; background-color: #99ff99;"></div></div>	
642	Bug	CMED-User-App	Closed	Normal			Inputting large number in Height Field Crashes the app (Production & Staging Build)	Borhan Siddik	Habibur Rahman	03/22/2020 12:56 PM	0:00	<div style="width: 100%;"><div style="width: 100%; background-color: #99ff99;"></div></div>	
641	Bug	CMED-User-App	Closed	Immediate			Getting error blood group Issue (Production & Staging Build)	Borhan Siddik	Habibur Rahman	03/24/2020 12:25 PM	1:20	<div style="width: 100%;"><div style="width: 100%; background-color: #99ff99;"></div></div>	

Figure 4.7: Example of issues reported for CMED User APP

These issues and bugs were found during the time of checking and testing the applications repeatedly. I used to think from a user's perspective and consider the probable cases that might generate an error in the software. Sometimes I would put large and garbage values in the input fields to check whether the apps could pass the stress tests.

Example of a high priority bug and its related conversations to solve the problem

Bug #873

Whatever date range is selected from February 2020 measurement done staying the same

Added by Berhan Siddik 22 days ago, updated 16 days ago.

Status:	New	Start date:	03/30/2020
Priority:	High	Due date:	
Assignee:	Sayem Hossain	% Done:	0%
Category:	Web	Estimated time:	

Description: Credential: corp_wedecatastasis Stage: Server

Attachments: webcast.png (176 KB), webcast1.png (179 KB), measurement.png (133 KB)

Subtasks: Add

Related issues: Add

History:

- Uploading by Habibur Rahman 22 days ago
 - Assignee changed from Habibur Rahman to Sayem Hossain
- Uploading by Sayem Hossain 20 days ago
 - Assignee changed from Sayem Hossain to Abdur Razzaq
- Uploading by Abdur Razzaq 20 days ago
 - Category set to Web
 - Assignee changed from Abdur Razzaq to Anjali Raj
 - Priority changed from Normal to High
- Anjali Raj please have a look at this issue
 - Uploading by Berhan Siddik 17 days ago
 - File measurementtime.png added
- Uploading by Anjali Raj 14 days ago
 - Assignee changed from Anjali Raj to Sayem Hossain

Notes: I have checked from front end, date is always 22/1/70/7/9900(Saturday, 29 March 1980) for Measurement/Corona/Screening/Attendance API and every time received response months range is last month to previous 12 months.. It doesn't change... so I believe this issue should be solved from back-end side.
Also last update in this issue is because is connected to back-end.
In both cases there could be only problem from my side is wrong value of request parameter, but I have checked it, I am providing given value from user.

Also available in: Atom | PDF

Figure 4.8: Inside of a discussion of high priority issue

Sometimes I found scenarios that could improve user experience and then suggest them in Redmine and assign them to the QA leaders for further confirmation. Figure 4.9 contains features and enhancements that I considered suggesting for improvements

#	Project	Tracker	Status	Subject	Author
1001	CMED-Corp-Agent-App	Enhancement	Closed	Address issue	Berhan Siddik
864	CORONA	Enhancement	Closed	Need a separator	Berhan Siddik
543	PNSF-App	Enhancement	New	Measurement icon (+) becoming hidden when multiple measurements are taken	Berhan Siddik
1037	CMED-User-App	Enhancement	New	Improper report result for corona measurement	Berhan Siddik
1019	CORONA	Enhancement	Closed	Age typing incompleteness	Berhan Siddik
774	CMED-Corp-Agent-App	Enhancement	Closed	Large font size for Corona Module	Berhan Siddik
917	CORONA	Enhancement	Closed	Low contrast in Screening Result	Berhan Siddik
915	CORONA	Enhancement	New	Minimize/Hide icon not correctly representing It's Function	Berhan Siddik
338	CMED - IT Support	Support	Closed	Need two testing devices	Berhan Siddik
757	CMED-Corp-Web	Feature	In Progress	Company Logo is Missing	Berhan Siddik
111	CMED-Corp-Agent-App	Feature	New	Measurement Report Feature for SMS (Recommended)	Berhan Siddik
279	CMED-Corp-Web	Feature	New	Need a better response features	Berhan Siddik
52	PNSF-Web	Feature	Closed	Year, month filter placement reorder	Berhan Siddik

Figure 4.9: Suggested features and improvements

4.2.3 Testing of Corona Module Integration

As I mentioned earlier, at the time of coronavirus pandemic, the management required a module integrated to all the existing applications that can be used to screen coronavirus cases in addition to the normal services that CMED provides. Within a very short period of time, a module was developed and integrated to all the existing applications and all the testers were assigned to the testing of the module of their respective projects.

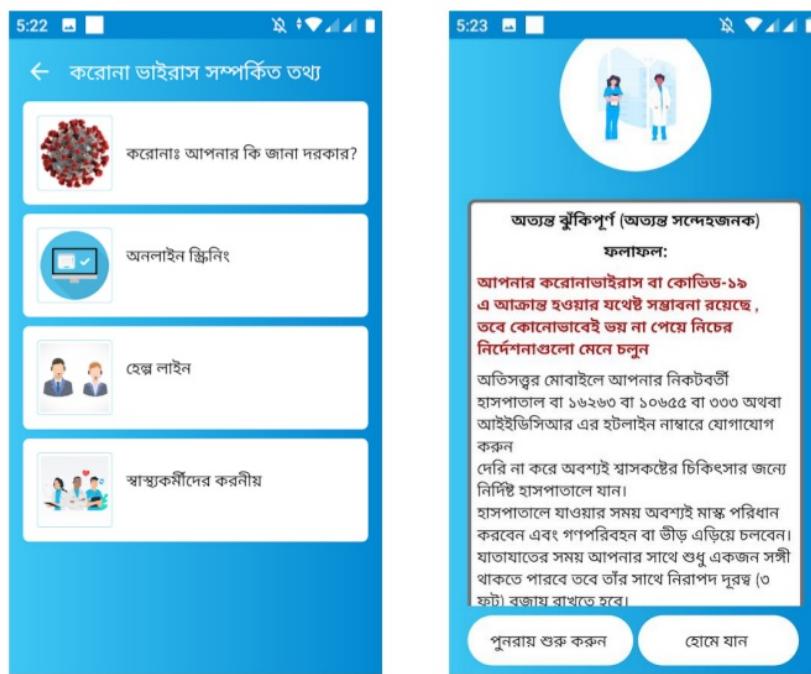


Figure 4.10: Screening of Corona Module in agent app

The Following are the issues I tracked, and enhancements suggested for the Corona project while working online from home.

The screenshot shows a table of issues and enhancements. The columns include Tracker, Project, Status, Priority, Parent task, Subject, Author, Assignee, Updated, Total estimated time, Total spent time, and % Done. The data includes:

Tracker	Project	Status	Priority	Parent task	Subject	Author	Assignee	Updated	Total estimated time	Total spent time	% Done
1019	Enhancement	CORONA	New	Normal	Age typing inconvenience Same color has different portion in the graph. Also Legend language does not match with the graph	Borhan Siddik	Raj Alampir	04/08/2020 05:09 PM	0:00		
1018	Bug	CORONA	New	Normal	Other Gender affecting the web results	Borhan Siddik	Mohammad Nayem	04/13/2020 07:21 PM	0:30	<div style="width: 30%;"></div>	
1006	Bug	CORONA	New	Urgent	Low contrast in Screening Result	Borhan Siddik	Habilur Rahman	04/12/2020 11:17 AM	0:00		
917	Enhancement	CORONA	Closed	Normal	Minimize/Hide icon not correctly representing its function	Borhan Siddik	Shihab Hossain	04/08/2020 10:39 AM	0:00	<div style="width: 100%;"></div>	
915	Enhancement	CORONA	New	Normal	Need a separator	Borhan Siddik	Habilur Rahman	04/07/2020 01:16 PM	0:00		
864	Enhancement	CORONA	Closed	High	Wrong link name	Borhan Siddik	Habilur Rahman	04/19/2020 12:09 PM	0:30	<div style="width: 100%;"></div>	
863	Bug	CORONA	Closed	Normal		Borhan Siddik	Habilur Rahman	04/05/2020 11:23 AM	0:30	<div style="width: 100%;"></div>	

Figure 4.11: Example of Corona issues and enhancements

4.3 Utilizing Swagger UI for CRUD operations

During the time of testing applications, sometimes I needed to check data back and forth with the frontend and backend, sometimes I was required to create, modify or delete some agent or user information from the management team. To handle such operations, with the help of the backend team I was able to learn the Swagger UI, a tool that provides the ability to visualize and interact with the API resources without the knowledge of implementation logic. I would check data from the dashboard

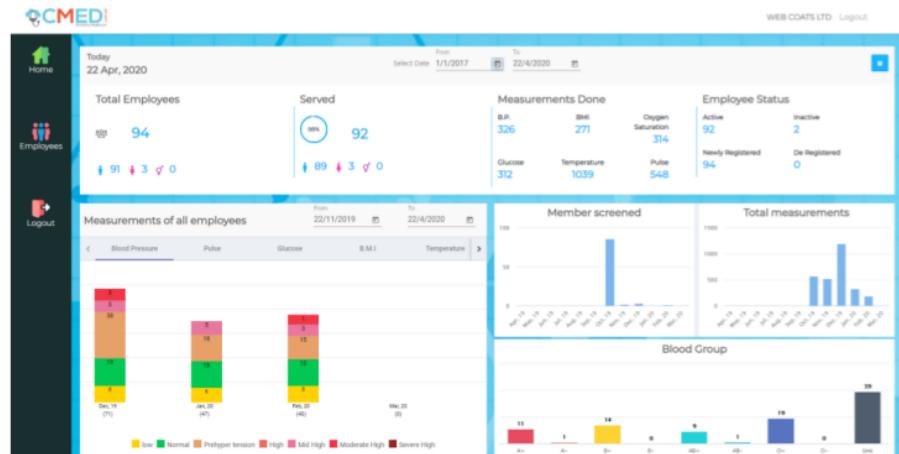


Figure 4.12: Data from web dashboard

Then match the data with backend to identify any miss-match.

```
Request URL:  
http://cmcd-core-staging.cmcdhealth.com/api/v0/statistics/corporate/dashboard/employees?from_date=1483220000000&to_date=1547513600000  
Server response  
Code Details  
200 Response body  
[  
    "no_of_total_employee": 94,  
    "no_of_total_active_employee": 92,  
    "no_of_total_inactive_employee": 2,  
    "no_of_total_registered_employee": 94,  
    "no_of_total_de_registered_employee": 0,  
    "no_of_total_served_employee": 92,  
    "measurement_type": [  
        {"count": 326,  
         "code_en": "BP",  
         "name_en": "Blood Pressure",  
         "name_bn": "ডায়াগনেজিং"},  
        {"count": 1839,  
         "code_en": "TEMP",  
         "name_en": "Temperature",  
         "name_bn": "টেম্পেচচুরেল"},  
        {"count": 171,  
         "code_en": "HR",  
         "name_en": "HR",  
         "name_bn": "প্রেসুচুরেল"}  
    ]  
]
```

Figure 4.13: Data received from backend

Manually from the applications, it was very time consuming whenever a large set of data needed to be uploaded or changed. I was instructed to use some import APIs in Swagger that could take a list of data in a CSV file and update them all at once. This was very convenient for adding or editing multiple agents, users, or addresses.

Here is an example of a CSV file containing some district information that I needed to upload under the division ‘Mymensingh’ with the division id of 8.

	A	B	C	D	E	F	G	H	I	J	K
1	id	name_en	name_bn	bbs_code	division_bbs_code						
2	22	JAMALPUR	জামালপুর	39	45						
3	27	MYMENSINGH	ময়মেন্সিঙ্গ	61	45						
4	30	NETRAKONA	নেত্রকোণা	72	45						
5	33	SHERPUR	শেরপুর	89	45						
6											
7											
8											
9											
10											
11											

Figure 4.14: CSV to import the districts

Then I uploaded the file on the server using the ‘Import allDistrict’ API with the super admin access given by the backend team

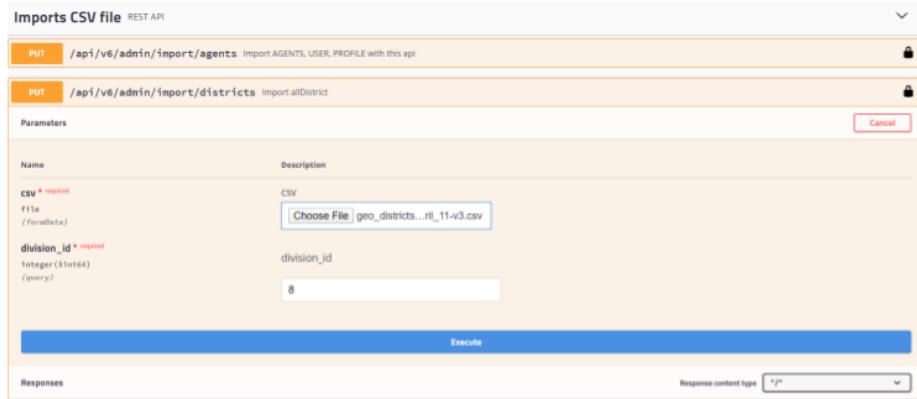


Figure 4.15: Uploading the CSV to import API

After importing the file I read the districts under the division with id 8 to make sure that my uploaded districts are listed correctly under the inputted division.



Figure 4.16: Checking to ensure successful import

CHAPTER 5

CONCLUSION

I can conclude that working as an intern at CMED was a wonderful and rewarding experience for me. Perhaps, it will be one of the most significant memories of my life as it was my first-time experience in the professional world. I was able to meet some amazing people. The employees and staff were exceptionally friendly and co-operative and treated me as a part of the CMED family. Working in the office environment while watching the programmers, developers, and testers interacting with each other to plan and approach in solving a certain problem was really inspiring for me to improve my communication skills and professionalism. Working under time constraints on a daily basis, I came to know my weaknesses and where I need to focus more to improve myself. I did not use to know the importance of a tester in software development and it became very clear to me after working a while in the testing department. If I ever become a developer, I would be able to address and consider the cases of probable failures and imperfections by thinking from a tester's perspective.

REFERENCE

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- [2] Rajkumar, "What Is Software Testing – Definition, Types, Methods, Approaches," 13 November 2019. [Online]. Available: <https://www.softwaretestingmaterial.com/software-testing/>. [Accessed April 2020].

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