

Creating the New Face of Buildertrend

Design Document

Team: sddec20-07

Client: Buildertrend

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Executive Summary

Development Standards & Practices Used

List all standard circuit, hardware, software practices used in this project. List all the engineering standards that apply to this project that were considered.

- Write clean, well documented, modular code
- Follow the Buildertrend React migration progress
 - Work with BT dev, product, and QA teams
- Follow Buildertrend frontend design guidelines
- The React pages should be composed of high quality, correct, bug-free code

Summary of Requirements

- The team must adhere to all confidentiality agreements set by our client
- Meet with the client once a week
- Maintain communication with Buildertrend teams
 - Microsoft Teams
 - Pull Request Comments / Suggestions
- Each team member must contribute at least 3 hours of work a week
- Tech discoveries must be done before each page is created
- The team must test original pages and log the results
- Build React common components
- Use the given Buildertrend API

Applicable Courses from Iowa State University Curriculum

List all Iowa State University courses whose contents were applicable to your project.

- Com S 227
- Com S 228
- Com S 309
- S E 319
- SE 362

New Skills/Knowledge acquired that was not taught in courses

List all new skills/knowledge that your team acquired which was not part of your Iowa State curriculum in order to complete this project.

- React Development
- Conversion of legacy code to new platform
- Testing, quality assurance, and documentation of previously written code (tech discoveries)
- Communication with client

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List of figures/tables/symbols/definitions (This should be the similar to the project plan)

1. Introduction

1.1 Acknowledgement

This project is being sponsored by Buildertrend Solutions. Our team received technical assistance and guidance from Buildertrend's Senior Architect Rick Kalasky, Project Manager Alli Kellner, and Software Developers Daric Teske and Cameron Hessler.

1.2 Problem and Project Statement

General problem statement: Buildertrend is currently in the process of trying to improve the speed and stability of their application website. To do this, Buildertrend is converting their outdated code into something newer, faster, and more efficient through the help of ReactJs. This conversion is taking time though, which is straining Buildertrend's team, seeing as they must currently support two different front-end systems.

General solution approach: Our senior design team will be responsible for building as many of Buildertrend's new website pages as possible. Our team will be given access to the existing Buildertrend pages and will be responsible for reverse engineering them into ReactJs. The pages our team creates for Buildertrend are expected to replace the older pages and will go live on the company's website by the end of the senior design year. While we are only required to convert a minimum of three pages, our senior design team is hoping to accomplish much more than this. Our project will greatly help Buildertrend by speeding up the React Migration the company has been undergoing for about a year now.

1.3 Operational Environment

Buildertrend provides its clients with software meant to simplify and optimize the building experience for homeowners, contractors, and remodelers. The environment in which our pages will be used will primarily be on an online application, accessible through laptops, desktops, and mobile devices. Due to the nature of most technology applications, our pages must be quick, reliable, stable, and thoroughly tested. We wish to avoid pages that crash or lag often, seeing as we want the users to have a pleasant experience using the Buildertrend application.

1.4 Requirements

List all requirements for your project – functional requirements within your project context, economic/market requirements, environmental requirements, UI requirements, and any others relevant to your project.

1. We will be required to complete tech discoveries for each web page we recreate to capture all of the requirements of the page we are recreating.
2. We will be required to complete the project utilizing React Components when dealing with the User Interface recreations.
3. We will be required to implement the solutions utilizing API's that Buildertrend already has in place at their company.
4. We will be required to keep our code on an internal Buildertrend Git repository
5. We will be required to use Visual Studio and Visual Studio Code as we develop our code.
6. Testing must be done utilizing Storybook and React testing libraries.
7. Some User Interface components must be designed using the Antd library.

1.5 Intended Users and Uses

Intended Users	Intended Uses
Homebuilders	<ol style="list-style-type: none"> 1. Everything you need to manage the home building process from start to finish. 2. Turbo charge your efficiency with the Buildertrend platform. 3. Customer management tools that allow you to keep your customers up to date on the project. 4. Project Management tools that allow you to easily view documents, mark up plans, manage scheduling, send estimates and more. 5. Financial tools that allow you to set budgets, send purchase orders, formalize pricing and manage the lifecycle for your

	projects.
Remodlers	<ol style="list-style-type: none"> 1. Renovate your business model with a full suite of tools and resources. 2. Connect with your crew, keep your customers happy and grow your business with help from Buildertrend. 3. Customer management tools that allow you to keep your customers up to date on the project. 4. Project Management tools that allow you to easily view documents, mark up plans, manage scheduling, send estimates and more. 5. Financial tools that allow you to set budgets, send purchase orders, formalize pricing and manage the lifecycle for your projects.
Speciality Contractors	<ol style="list-style-type: none"> 1. Solutions that are adaptable, intuitive, and focused on boosting profitability. 2. A single, powerful platform is all you need to expertly manage all aspects of your business. 3. Customer management tools that allow you to keep your customers up to date on the project. 4. Financial tools that allow you to set budgets, send purchase orders, formalize pricing and manage the lifecycle for your projects. 5. Pre-sales process tools that allow you to manage new leads, win more bids and streamline your sales process with tools that belong on a superhero's utility belt.
Commercial Contractors	<ol style="list-style-type: none"> 1. Grow your business with powerful project management tools. 2. Take your business to the next level with software that's as ambitious as you. 3. Project Management tools that allow you to easily view documents, mark up plans, manage scheduling, send estimates and more.

	<p>4. Financial tools that allow you to set budgets, send purchase orders, formalize pricing and manage the lifecycle for your projects.</p> <p>5. Pre-sales process tools that allow you to manage new leads, win more bids and streamline your sales process with tools that belong on a superhero's utility belt.</p>
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1.6 Assumptions and Limitations

Assumptions	
Design (color scheme)	All web pages will follow the required Buildertrend company color scheme.
Methodology	The project will be completed using the tools and techniques prescribed by the Buildertrend methodology.
Technology	The project will use the following technology, tools, and libraries: React, Formik, Storybook, Ant Design, and TypeScript.
Product Environment	All web pages must be accessible through the Buildertrend website and able to be viewed on laptops, desktops, tablets, and mobile devices.
Product Performance	The maximum number of simultaneous users / customers is unknown at this time. The number of users / customers varies greatly depending on the season. For now we will assume a maximum number of simultaneous users to be 100. This is important because we want to

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	ensure that our pages are quick, reliable, and stable. If we underestimate the number of simultaneous users then the pages may crash or lag often.
End product geographical use	The end product will be used all over the world.
Team Performance & Skill	Each team member is expected to have the necessary technological skills to be able to contribute to the project in a meaningful way.

Limitations	
Budget & Finance	The cost of completing the product shall be no more than \$500, which is the allotment given to us by department for senior design projects.
Schedule	The project must be completed by the end of the senior design year in December 2020.
Scope	A minimum of 3 web pages will be converted to react.

1.7 Expected End Product and Deliverables

At the end of our senior design product, we will have recreated at least three web pages for Buildertrend. Each web page should look and function as close to the original web page as possible. All documentation regarding the web pages will be commented within the code. The web pages will be delivered periodically throughout the Spring and Fall

2020 semesters; we do not currently have set deadlines, however, the final products are expected to be deployed in December 2020.

2. Specifications and Analysis

2.1 Proposed Approach

Our planned general approach to this project is to follow Buildertrend's tech discoveries guidelines on existing Buildertrend web pages. Tech discoveries will allow our team to essentially do black-box testing on the existing pages, which will allow us to not only familiarize ourselves with the functionality of the page, but will also allow us to find any existing problems or bugs that have gone unnoticed. Our senior design team will coordinate with Buildertrend's Code Health team to make sure all of the required APIs for our pages exist and are functioning correctly. From there, our team will reverse engineer the pages using ReactJs and the APIs provided by Buildertrend's team.

Once our newly created ReactJs pages have been pushed to the Buildertrend Bitbucket repo, a React Migration manager will code review our team's work. Once our pages have been thoroughly tested, documented, and reviewed, our newly migrated pages will be deemed "Dev Complete" and will be passed on to a Code Health team member. Should Code Health find any significant problems with our pages, they will be returned to our senior design team to either edit or fix the work. Otherwise, Code Health will essentially finish the page and we will be able to start on our next migration.

2.2 Design Analysis

Although our team had been road blocked for most of the semester, first by non-disclosure agreements and then by our assigned pages being taken by another team, we finally have a start on our project. During our meeting with Buildertrend the week before spring break, Daric informed us that we have our first page: a Data Science Information (DSI) page. Our team members have been working to set up our machines by cloning the Buildertrend Bitbucket repository, installing our Amazon Web Services VM, and familiarizing ourselves with the Buildertrend app. We have begun our tech discovery for the DSI page, which we will continue over the course of the next couple of

days. Once the tech discovery is finished, we will create a branch in the repo and begin assigning tasks on our Trello board.

As we move forward, communication and organization are going to be key for our project, especially considering we will be working remotely from now on. It will be important for our team to check in often and frequently, so we can avoid stepping on each other's toes or overwriting each other's code. Our proposed plan of working in one page branch and creating smaller branches off of this one in our repository seems like a strong plan as of now. Daric approved of this idea and it seems this will be the best way to keep our work clean and organized.

Our architecture of our project will be coherent with Buildertrend's architecture that they have in place for all their applications. The React pages that we work on will be created on a premade API that is made for us by Buildertrend. We will stick to what development practices Buildertrend outlines us to follow. Our expected results will be at a minimum three pages fully converted by the end.

2.3 Development Process

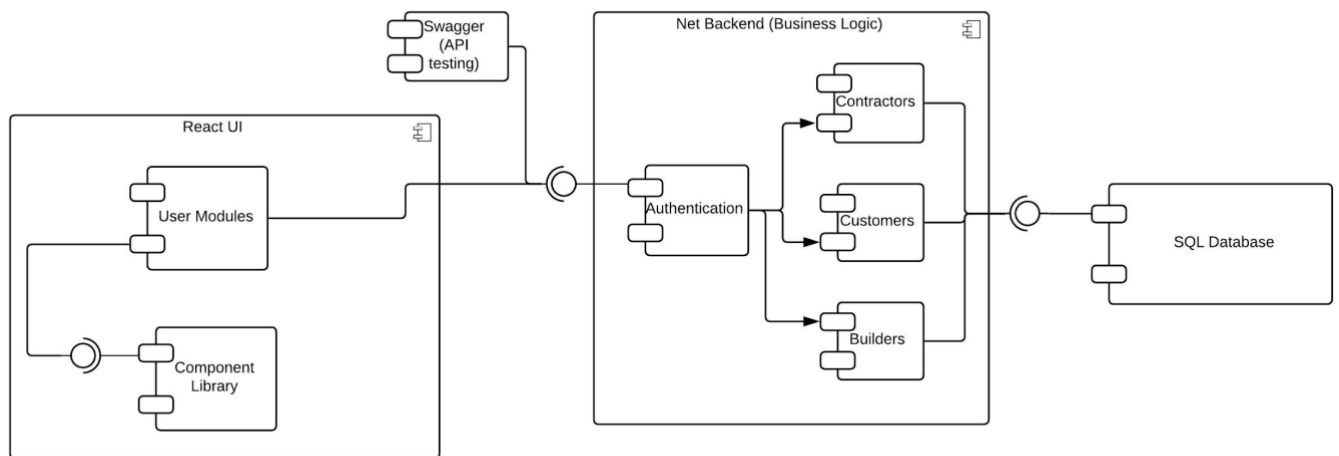
Our team will be using an agile approach. We will be treating our Trello board as our scrum board, which will be updated regularly with tasks and cards that our team needs to complete. Each task will be assigned to a team member, and everyone will be responsible for marking their tasks complete once they are finished.

Our team will also be using Bitbucket to organize our work. Each of our team members will clone a repository Buildertrend created specifically for this React Migration. From there, we will create a branch for each page we are working on, and we will branch off of our page branch for any individual tasks we need to complete. This method will allow us to avoid merging incomplete work into master, which could potentially produce negative side effects for the rest of the repo. Only once our page is fully complete will we submit a pull request, which will need to be approved by Daric. If our work is clean, bug-free, and meets Buildertrend's coding standards, our page branch will be merged into master and our team will be able to move on to the next page.

We are opting for an agile approach due to the flexibility and adaptability this type of development process usually allows. Every page we get will be different, with some much larger and requiring much more work than others. Because of this, our team feels

it will be best to do iterative development. After each iteration, our team should have new working code and more progress made than if we tried to do waterfall or TDD.

2.4 Conceptual Sketch



3. Statement of Work

3.1 Previous Work And Literature

The existing work that we will be following will come directly from the Buildertrend application itself. Since we are not actually creating anything new, our work won't really be affected or influenced by other products in the market. We have been given existing Buildertrend web pages that we must recreate using ReactJs. The advantage to this is that our team doesn't have to worry about designing any new pages or building APIs for these pages to use. The layout, design, and API of each page we will be building already exists. This puts less of a burden on our group and reduces the chance of failure in our project. Due to our limited work experience, creating and designing a page from scratch could have been difficult for our group or would have created more obstacles.

The disadvantage of this project is that the design experience we could have gotten had we been assigned to build a page from scratch would have been valuable to each of our team members. In addition, our creativity when working on these pages will be slightly stifled, considering the pages we are building already exist, simply in another coding language. We are not allowed to change much about the pages. We are only supposed to rewrite them using ReactJs.

3.2 Technology Considerations

The biggest advantage to using ReactJs is its speed. React is known for using “components,” which are small fragments of a web page, such as a modal or a nav bar. React will update only those components which have been modified instead of reloading the entire page, which makes React a very quick and efficient language to use for websites. This was the entire motivation behind using ReactJs to replace the current Buildertrend web page code.

3.3 Task Decomposition

Each web page will be done one at a time. Before starting each web page, we will first do a tech discovery where we analyze the page to see its setup and how it performs. We will write all of this information down and then we will split up the web page into equal sections for each team member to complete on their own. Each team member will fork from our page branch on the repository, and we will each be responsible for merging our fork to the branch once our work is complete. Once all the tasks are complete for the page branch, our team will submit a pull request to Daric, who will merge the branch in to master if there are no problems with our work.

3.4 Possible Risks And Risk Management

Include any concerns or details that may slow or hinder your plan as it is now. These may include anything to do with costs, materials, equipment, knowledge of area, accuracy issues, etc.

Some possible risks for this project involve knowledge of the required coding languages. Failing to know any of the required languages or how to implement something in any of

the required languages will hinder our progress. Additionally, if pieces of the code are implemented in inaccurate or nonoptimal ways, this will also slow our progress.

3.5 Project Proposed Milestones and Evaluation Criteria

What are some key milestones in your proposed project? Consider developing task-wise milestones. What tests will your group perform to confirm it works?

Each milestone will be the completion of a page. The pages will be tested while we are coding and after it has been completed; we will run the web page to ensure it is operating in the exact ways the original web page operated. As of right now, we will not be writing any tests for the web

3.6 Project Tracking Procedures

What will your group use to track progress throughout the course of this and next semester?

Our team will be tracking our progress through a Trello board and we will also be keeping track of how much time everyone has been putting in through our bi-weekly reports. Additionally, we will be giving each other and our client updates during our meetings.

3.7 Expected Results and Validation

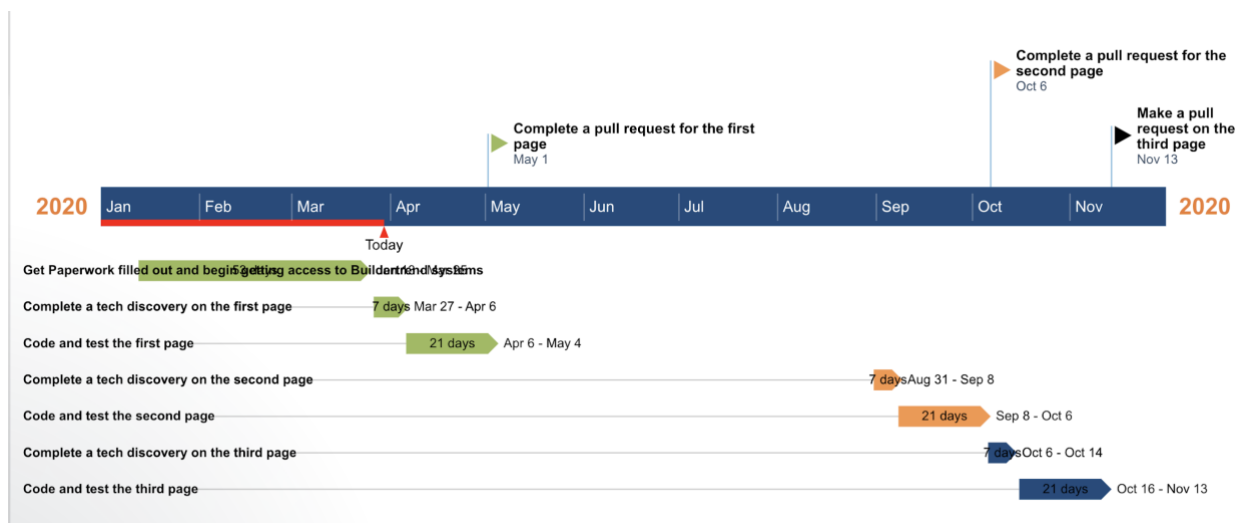
What is the desired outcome?

How will you confirm that your solutions work at a **High level**?

By December 2020, we are expecting to have recreated three-four web pages for Buildertrend. These web pages should look and behave exactly like the original web pages we are given. We will confirm our results by checking the looks and performance of our recreated web pages to the original web pages through our tech discoveries.

4. Project Timeline, Estimated Resources, and Challenges

4.1 Project Timeline



This timeline is not exact as this project will require us to be very flexible since we are working with a company on multiple pages. Buildertrend expects us to finish at least three web pages converting them from ASP to React. The Gantt chart above shows three pages being completed and the dates they should tentatively be done. Since we only have a month left in the semester, the hope would be to complete one page but if we do not, we will adjust our schedule to get at least three done by the end of the second semester of Senior Design. As shown in the chart, it took quite a long time for us to receive access to the systems from Buildertrend and we are starting the development a little bit later than we would have liked.

Each page will have three steps to complete ending with a pull request on Git. For each page, we will have to document the page we are recreating accounting for all features of

the page in a tech discovery. Then we will work on the page as a team with multiple branches on Git. Once we have completed all of our tasks, we will make a final merge and complete a pull request into the pipeline for Buildertrend.

4.2 Feasibility Assessment

With our progression through the semester our team has been fully integrated into Buildertrend's network and workspace. To most of us who haven't worked at Buildertrend before, it will take some time to get used to the development process that they have in place. This ranges from working with new platforms, testing, and documentation of tech discoveries. Once our team is used to this new environment we will realistically be able to deliver at least three fully migrated React pages.

4.3 Personnel Effort Requirements

Include a detailed estimate in the form of a table accompanied by a textual reference and explanation. This estimate shall be done on a task-by-task basis and should be based on the projected effort required to perform the task correctly and not just "X" hours per week for the number of weeks that the task is active

Task	Time (hours to completion)	Projected Effort (scale of 1 (little effort to) to 5 (most effort))
Research (learning how to use React, Formik, Storybook, Ant Design, and TypeScript)	30 - 50 hours	Avg 3 (depending on the member's familiarity with the tools it may take more or less effort)
Tech Discoveries (need to be very detailed documentation about the interactions, api calls for each page)	10 - 20 hours total per page	Avg 4 (because these task requires a lot of detail it will require more effort)
Development (Programming pages, Git Commits)	20 - 60 hours total per page (depending on how large the page is)	Avg 4 (the team works simultaneously on each page so having each page being worked on by 6 people will be hard)

Testing (testing to see if each page performs the required actions)	3 - 7 hours total per page	Avg 2 (use black box testing)
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4.4 Other Resource Requirements

Identify the other resources aside from financial, such as parts and materials that are required to conduct the project.

Aside from a laptop there are not any other resources that are required to conduct the project. The project can be completed in its entirety from each group member's laptop.

4.5 Financial Requirements

If relevant, include the total financial resources required to conduct the project.

There are no required financial resources for this project.

5. Testing and Implementation

Testing is an **extremely** important component of most projects, whether it involves a circuit, a process, or a software library

Although the tooling is usually significantly different, the testing process is typically quite similar regardless of CprE, EE, or SE themed project:

1. Define the needed types of tests (unit testing for modules, integrity testing for interfaces, user-study for functional and non-functional requirements)
2. Define the individual items to be tested
3. Define, design, and develop the actual test cases
4. Determine the anticipated test results for each test case 5. Perform the actual tests

6. Evaluate the actual test results
7. Make the necessary changes to the product being tested
8. Perform any necessary retesting
9. Document the entire testing process and its results

Include Functional and Non-Functional Testing, Modeling and Simulations, challenges you've determined.

5.1 Interface Specifications

- Discuss any hardware/software interfacing that you are working on for testing your project

5.2 Hardware and software

- Indicate any hardware and/or software used in the testing phase
- Provide brief, simple introductions for each to explain the usefulness of each

5.3 Functional Testing

Examples include unit, integration, system, acceptance testing

5.4 Non-Functional Testing

Testing for performance, security, usability, compatibility

5.5 Process

- Explain how each method indicated in Section 2 was tested
- Flow diagram of the process if applicable (should be for most projects)

5.6 Results

- List and explain any and all results obtained so far during the testing phase
 - – Include failures and successes
 - – Explain what you learned and how you are planning to change it as you progress with your project
 - – If you are including figures, please include captions and cite it in the text
 - This part will likely need to be refined in your 492 semester where the majority of the implementation and testing work will take place

-**Modeling and Simulation:** This could be logic analyzation, waveform outputs, block testing. 3D model renders, modeling graphs.

-List the **implementation Issues and Challenges**.

6. Closing Material

6.1 Conclusion

Summarize the work you have done so far. Briefly re-iterate your goals. Then, re-iterate the best plan of action (or solution) to achieving your goals and indicate why this surpasses all other possible solutions tested.

6.2 References

This will likely be different than in project plan, since these will be technical references versus related work / market survey references. Do professional citation style(ex. IEEE).

6.3 Appendices

Any additional information that would be helpful to the evaluation of your design document.

If you have any large graphs, tables, or similar that does not directly pertain to the problem but helps support it, include that here. This would also be a good area to include hardware/software manuals used. May include CAD files, circuit schematics, layout etc. PCB testing issues etc. Software bugs etc.