Terrain Exploration and Rescue Vehicle - TEARv

Sprint1 Planning Document

Team 36 - Rishabh Ramsisaria, Dominic Miller, Xu He, Shaurya Sinha, Rahul Balla

Table of Contents

Overview

For the first sprint, our goal is to build the car that can be controlled through the Pi, develop the Android Client to display all the screens to match the mockups, and have the backend ready to handle user authentication. The user will be able to register an account using an email and also create a username and password. They will also have the option to change their username and password. The backend will be set up such that the user's information will be updated in the database based the changes made by them. For the hardware, the Pi will set up such that it can control the motors of the cars and also the temperature and humidity sensor.

Scrum Master: Rishabh Ramsisaria

Meeting Plan: Wednesday at 5:30pm, Sunday at 12pm

Risks and Challenges: One of the challenges of completing the tasks within this sprint is taking time to get familiar with Android Studio to develop the frontend for the mobile app. Setting up the database in Firebase, and creating the endpoints using Python and Flask framework is also going to take some time to get familiar with. Another challenge is to attain good movement of the car. This is going to take some time because a lot of testing needs to be done so that all the motors need to move in a straight direction. Sometimes, due to faulty motors the car may move in a wobbly manner. Another risk is shorting of sensors. Supplying high voltage from the Pi to the sensors may short them. Also, we are trying to finish a lot of stuff just after Sprint 1 and are expecting some work overflow in the end but have set our targets such that we can finish as much work as fast as possible to allow more time for testing.

Current Sprint Detail

Hardware

Assembly

User Story 1:
As a user, I would like the car to be built properly and sturdily, ready to be controlled by the Python software in the Pi.

#	Task Description	Estimated Time (hours)	Owner
1.	Assemble the robust chassis of the car	3	Dominic
2.	Connect each of the wheel motors to the H-Bridge and the temperature and humidity sensor to the Pi	2	Rishabh
3.	Connect the Raspberry Pi Camera	1	Rishabh
4.	Write a script to start the necessary programs as soon as the Pi is turned on	2	Rishabh
5.	Testing	2	Dominic and Rishabh

Acceptance Criteria:

1. Given the chassis is built completely, when the car joints are tugged on, they should be sturdy enough to not show any signs of breaking or disconnecting.
2. Given the wired connections are complete, when the car moves or topples, the wires should not tangle or disconnect from their appropriate connections.
3. Given all the connections are finished and all the control code has been written, when the Pi is turned on, all the programs including that for control, sensors as well as camera should be started and awaiting commands.

User Story 2:
As a user, I would like to be able to rotate the camera mounted on the vehicle so that I can get a 360° view of my surroundings

#	Task Description	Estimated Time (hours)	Owner
1.	Create a space on the car where the camera can efficiently rotate 360° around without tangling or resistance	4	Dominic
2.	Add the motor that moves the camera in 360° of motion, making sure it fits,works, and is a solid build	4	Dominic
3.	Set up the correct resolution required for the video feed to display in portrait on the app	2	Rishabh
4.	Set up the live feed for the camera	3	Rishabh
5.	Testing	3	Dominic and Rishabh

Acceptance Criteria:

1. Given the camera has been set up properly on the Pi display, when the home screen with the live feed is displayed on the emulator, the resolution should be perfect for the phone we will be using for testing (Samsung Galaxy S8)
2. Given the motor is connected to the Pi correctly, when the command to move the camera is given, the display should change according to the direction of the command (left or right)
3. Given the camera connections are completed, when the script for the camera live feed is started, we should be able to see the feed on the browser

User Story 3:
As a project owner, I would like to reverse the polarity of the motors so that the car can move in all directions smoothly

#	Task Description	Estimated Time (hours)	Owner
1.	Reverse the polarity using the H-Bridge allowing for forward and backward movement	3	Dominic
2.	Testing	1	Dominic

Acceptance Criteria:

1. Given that the polarity is reversed properly, when a user wants to move backwards, then the car will move backwards by moving the back wheels in the appropriate direction
2. Given that the H-Bridge is wired up correctly, when a backward-left command is sent, then only the back left wheel will turn in the appropriate direction to move the car.
3. Given that the H-Bridge is wired up correctly, when a backward-right command is sent, then only the back right wheel will turn in the appropriate direction to move the car.
4. Given that the Pi can send out the proper signals differentiating between forward and backwards, when the car is meant to move backwards, then the H-Bridge will know to reverse the polarity and send the appropriate signal to the motors.

User Story 4:
As a user, I would like the hardware to respond to movement commands quickly so that the actions and movements of the car happen in real time and can be seen through the camera

#	Task Description	Estimated Time (hours)	Owner
1.	Implement the movement and control functions for the car, written in Python	8	Rishabh
2.	Implement the Python code for the camera motor on top of the car	5	Dominic
3.	Set up all the listeners for the car to be controlled by keyboard commands	6	Dominic and Rishabh
4.	Testing	3	Dominic and Rishabh

Acceptance Criteria:

1. Given that the movement and control functions are implemented correctly, when a user presses a key on a keyboard (will transfer over to app wirelessly in later sprints), then the car will move in the direction that they chose.
2. Given that the camera control function was implemented correctly, when a user uses these controls to look around, then the camera will move accordingly allowing for a 360° field of view.
3. Given that all the control functions that were written work as intended and have been linked to respective keys on the keyboard, when a user presses a key they they know to be linked to an action, then the car/camera will perform that action exactly as intended.

Mobile Application

Authentication

User Story 1:
As a user, I would like to be able to register for a *TEARv* account using username, password, and email so that my information would remain personal to me

#	Task Description	Estimated Time (hours)	Owner
1.	Sign up for Firebase database	1	Shaurya
2.	Implement the ability to register for an account and set up a username, password and email	5	Shaurya
3.	Design the database schema to store user information, authentication information and vehicle information	4	Shaurya
4.	Make the authentication database secure from outside users	2	Shaurya
5.	Testing	2	Shaurya

Acceptance Criteria:

1. Given that the registration functionality has been correctly implemented, when a user enters the required fields and registers for an account, the user should be able to log into their account.
2. Given that the user has registered for an account, when a user logs in, they are directed to the screen presenting the app to them.
3. Given that the authentication functionality has been correctly implemented, when a user tries to access their information without the correct credentials, the user would be denied access.

User Story 2:
As a user, I would like to be able to recover both, my username and password, if I don't remember it so that I do not get locked out of my account using my registered email

#	Task Description	Estimated Time (hours)	Owner
1.	Set up mailer to send emails to users	5	Shaurya
2.	Implement functionality to recover username and password from the authentication backend	6	Shaurya
3.	Implement "Forgot Username" and "Forgot Password" button	4	Shaurya
4.	Testing	1	Shaurya

Acceptance Criteria:

1. Given that the mailer has been set up, when a user selects an action that necessitates the sending of an email, an email with relevant information is sent.
2. Given that the username/password recovery functionality has been correctly implemented, when a user requests the recovery of their username/password, they should receive an email with the requested information.
3. Given that the "Forgot Username" and "Forgot Password" buttons are correctly implemented, when a user clicks on one of the buttons, a confirmation alert should pop up asking if they would like to receive an email with the requested information.

User Story 3:
As a user, I would like to have the option to change my username and password

#	Task Description	Estimated Time (hours)	Owner
1.	Set up firebase connectivity guidelines for changing and updating the database	4	Rishabh
2.	If authentication fails, report appropriate messages	1	Rishabh
3.	Testing	2	Rishabh

Acceptance Criteria:

1. Given the change username/password functionalities have been setup, when the user clicks on the change username or change password buttons, a prompt for old username/password, new username/password and verification of new username/password should be sent respectively.
2. Given the prompt is sent, when the old username/password doesn't match the username/password associated with the current account, an error message is displayed.
3. Given the prompt is sent, when the new username/password doesn't match the new username/password in the verification field, an error message is displayed.

UI & UX

User Story 1:
As a user, I would like the app to be neat and easy to navigate so that it does not take time to learn

#	Task Description	Estimated Time (hours)	Owner#
1.	Set up LogIn page	5	Dominic
2.	Set up register page	5	Xu
3.	Set up Homepage	7	Rahul
4.	Set up Analytics page	5	Rahul
5.	Set up Settings page	5	Xu
6.	Set up Cars page	6	Xu
7.	Testing	4	Rahul, Dominic, and Xu

Acceptance Criteria:

1. Given that the user has entered his/her login information, when he/she has logged in successfully, he/she needs to be redirected to the Homepage
2. Given that the user has logged in, when he/she taps on the Analytics tab, the Analytics tab needs to be able to display graphical data and handle any exceptions
3. Given that the user has logged in, when he/she taps on the Settings tab, the Settings tab needs to be set up and handle any exceptions
4. Given that the user has logged in, when he/she taps on the Cars tab, the Cars tab needs to be set up and handle any exceptions
5. Given that the user has logged in, when he/she taps on the Register tab, the Register tab needs to be set up and handle any exceptions that may occur
6. Given that there is an error with opening the tabs, when the user navigates to that tab, the error needs to be handled

User Stories 2 & 3:
As a user, I would like the temperature readings to be displayed live on the screen as part of the live feed
As a user, I would like the temperature reading to change colours according to the level of danger (red for high or unsafe temperatures, green otherwise)

#	Task Description	Estimated Time (hours)	Owner#
1	Include temperature reading on the Homepage	3	Rahul
2	Change color of the reading number	3	Rahul
3.	Testing	1	Rahul

Acceptance Criteria:

1. Given that temperature reading is displayed, when it is above a certain range such as (> 45 degree Celsius or >120 degree Fahrenheit), its color should be red
2. Given that temperature reading is displayed, when the it is below a certain range (<45 degree Celsius or <120 degree Fahrenheit), its color should be red
3. Given that the home page is open, when temperature reading is not displayed, an error message should be displayed saying that temperature reading is not available

User Story 4:
As a disaster rescue operative, I would like to analyze the graphical data of the average temperature readings of the surrounding area so that I know how hot the environment is

#	Task Description	Estimated Time (hours)	Owner#
1	Generate graphs based on data received on Analytics page	8	Xu
2	Display temperature graph generated on Analytics page	6	Rahul
3.	Testing	3	Rahul and Xu

Acceptance Criteria:

1. Given that there the user has opened the Analytics, when there are no errors, a clearly labeled graph with an x-axis, y-axis, units and legend needs to be visible to the user
2. Given that the csv files are properly imported, when the user taps the Analytics tab, the user should be able to see the graphs of how the temperature has changed with time
3. Given that the csv files are not imported, when the user taps the Analytics tab, an error message needs to be displayed

Remaining Backlog (15/33 Stories Completed)

Mobile Application

Registration

1. ~~As a user, I would like to be able to register for a *TEARv* account using username, password, and email so that my information would remain personal to me~~
2. ~~As a user, I would like to be able to recover both, my username and password, if I don't remember it so that I do not get locked out of my account using my registered email~~
3. ~~As a user, I would like to have the option to change my username and password~~
4. As a user, I would like to be able to register multiple products under the same account to use for different purposes such as one for surveillance and another for testing

Video

5. ~~As a user, I would like to be able to receive a live feed from the vehicle so that I can see where I am going and navigate appropriately~~
6. As a user, I would like to be able to record videos in real-time so that I can capture important information
7. ~~As a user, I would like to be able to store videos locally so that I can view them later also~~
8. As a user, I would like to view the history of previously recorded videos so that I can visit them later again
9. As a disaster rescue operative, I would like the resolution to be good enough to analyze the video feed to determine structural integrity of the buildings and the rubble

Controllability

10. ~~As a user, I would like to be able to rotate the camera mounted on the vehicle so that I can get a 360° view of my surroundings~~
11. ~~As a user, I would like to move the car up, down, right, and left through a mobile app so that I can maneuver the car through difficult terrain~~
12. As a user, I would like to have the ability the control the speed of the car through the mobile app so that I move the car in varying speeds (if time allows)
13. As a user, I would like the car to navigate autonomously from one place to another so that the user can focus on other tasks as well (if time allows)

Connectivity

14. As a user, I would like to be able to connect to the car via wifi to be able to operate the car from a large distance
15. As a user, I would like to be able to connect to the car via bluetooth in case there isn't wifi (if time allows)
16. As a user, I would like the car to have its personal internet dongle to provide connectivity to the module (if time allows)
17. As a user, I would like the car to be able to return to the location of the phone it was connected to in case of a connection loss (if time allows)

UI & UX

~~18. As a user, I would like the app to be neat and easy to navigate so that it does not take time to learn~~
~~19. As a disaster rescue operative, I would like the car to have the ability to report the average temperature readings of the surrounding area so that I know how hot the environment is~~
~~20. As a user, I would like the temperature readings to be displayed live on the screen as part of the live feed~~
~~21. As a user, I would like the temperature reading to change colours according to the level of danger (red for high or unsafe temperatures, green otherwise)~~
22. As a user, I would like the app to report if any of the sensors are malfunctioning so that they can be replaced (if time allows)
23. As a user, I would like the vehicle to report back battery life as accurately as possible so that I can get the vehicle back to safety before the battery runs out (if time allows)
24. As a user, I would like to be able to have a GPS location reading so that I can know where the car is exactly at all times throughout its operation (if time allows)
25. As a user, I would like frequent software updates so that the vehicle can continue to run efficiently (if time allows)
26. As a user, I would like to be able to store data from sensors such as the temperature and relative humidity (RH) sensors and display them on the app in graphical form so that they can be analyzed easily (if time allows)

Hardware

Controllability of car

~~27. As a user, I would like to be able to rotate the camera mounted on the vehicle so that I can get a 360° view of my surroundings~~

~~28. As a user, I would like the hardware to respond to movement commands quickly so that the actions and movements of the car happen in real time and can be seen through the camera~~

~~29. As a project owner, I would like to reverse the polarity of the motors so that the car can move in all directions smoothly~~

30. As a disaster rescue operative, I would like to have a grid laser displayed on the terrain in front of the car so that it can simulate depth perception and highlight cracks or bumps in the terrain (if time allows)

31. As a disaster rescue operative, I would like the car to have the ability to sense surrounding rubble and not crash into them so that it does not get damaged (if time allows)

Modules

~~32. As a user, I would like to have the car be easy to modify using additional sensors or add-ons~~

33. As a disaster rescue operative, I would like to have the car equipped with flashlights so that I will be able to evaluate surroundings in low-light situations (if time allows)