Test Sheet – Ad Hoc Network Communication for Disaster Relief IR Communication Sub-System Test

Location	EE Building Design Studio
Date	20 December 2023
Time	18:00
Description	This test document is specifically crafted for evaluating ad hoc network communication within TechBatch's IR communication system. The primary objective is to conduct comprehensive tests, systematically collect the results, and subsequently publish a detailed report.
Aim	The testing serves the crucial purpose of assessing the initial design of the IR communication sub-system to ascertain its capacity to fulfill project requirements. It aims to primarily address potential challenges associated with radical design changes that may arise if these requirements are not met. This becomes particularly vital as the project advances into more complex stages. Consequently, this guide is formulated to validate the sub-system's ability to accurately transmit and receive data signals from the IR transmitter and receiver under diverse conditions.
Expected Outcome	It is expected to show that the design is able to communicate at different ranges and angles. The first aim is to ensure reliable communication up to 40 cm. The distance is varied from 10 cm to 50 cm and we are expecting to have reliable communication up to 40 cm. The second aim is to show communication in different angles. We are expecting reliable communication. The angle range is 0 to 180 degrees.
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Test Devices & Tools

1. Ruler

Ground truth: As a ground truth, the expected communication range of IR is 40 cm. Using a ruler, it is measured whether the range requirement is met.

2. Protractor

Ground truth: The expected communication angles, considered as the ground truth, are defined as follows:
At a distance of 10 cm between the mobile unit and the main unit, reliable communication is expected within the range of 0 to 180 degrees.
For a distance of 20 cm between the mobile unit and the main unit, reliable communication should occur within the range of 0 to 90 degrees.
At a distance of 30 cm between the mobile unit and the main unit, reliable communication is anticipated within the range of 0 to 60 degrees.
When the distance between the mobile unit and the main unit is 40 cm, reliable communication is expected within the range of 0 to 40 degrees.

The assessment of these angle requirements is conducted using a protractor to ensure accurate measurement and verification

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Test Environment

The testing environment for this subsystem was determined as the engineering design studio; However, it is important to note that the specific environment is not crucial for performing the tests. Therefore, the test can be performed in any suitable environment. To facilitate the testing process, a table was arranged on which distances were marked using tape at 10 cm intervals.

Figure 1: Test environment for IR communication.

Figure 2: Test environment for IR communication.

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Test Parameters

Parameter	Range	Step Size	Number of Measurements
Distance between emitter and transmitter	10-50 cm	10 cm	5
Angle of the transmitter	0-180°	15°	14

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1. Test Procedure

1. IR communication test for different distance between the mobile unit and base unit is planned. The procedure is as follows:

1. The ESP32s, to which the base unit and mobile unit are connected, are powered on by two different computers.
2. The file named "demo.ino" is opened and the program in the file is loaded to ESP32s.
3. The base unit and mobile unit will be positioned 10 cm distance between them. Base unit should be stationary and only mobile unit should move.
4. To check for communication, we will verify there is a reliable communication between base and mobile unit by printed messages on serial monitor of Arduino IDE.
5. It is recorded how many of the 10 messages sent were delivered successfully or not.
6. After the measurement, the distance will be increased by 10 cm, and the same steps will be repeated until 50 cm.

2. IR communication test for different angles between the emitter and transmitter is planned. The procedure is as follows:

1. The ESP32s, to which the base unit and mobile unit are connected, are powered on by two different computers.
2. The file named "demo.ino" is opened and the program in the file is loaded to ESP32s.
3. The base unit and mobile unit will be positioned 10 cm distance between them. Base unit should be stationary and only mobile unit should move.
4. The angle will start at 0 degree and be increased by 15 degrees in each step up to 180 degrees by moving mobile unit. Note that if the communication is lost at certain degree value, there is no need for measurements at further values.
5. To check for communication, we will verify there is reliable communication between base and mobile unit by printed messages on serial monitor of Arduino IDE.
6. It is recorded how many of the 10 messages sent were delivered successfully or not.
7. After the measurement, the distance will be increased by 10 cm, and the same steps will be repeated until 50 cm.

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Test Data

Table 1: Distance (@ 0 degree)

Parameter Value	Actual Performance	Expected Performance	Error
10		>99% reliable communication	
20		>95% reliable communication	
30		>90% reliable communication	
40		>80% reliable communication	
50		<10% reliable communication	

Table 2: Angle (@ 10cm)

Parameter Value	Actual Performance	Expected Performance	Error
0		>99% reliable communication	
15		>99% reliable communication	
30		>99% reliable communication	
45		>99% reliable communication	
60		>99% reliable communication	
75		>99% reliable communication	
90		>99% reliable communication	
105		>99% reliable communication	
120		>99% reliable communication	
135		>99% reliable communication	
150		>99% reliable communication	
165		>99% reliable communication	

180		>99% reliable communication	

Table 3: Angle (@ 20cm)

Parameter Value	Actual Performance	Expected Performance	Error
0		>95% reliable communication	
15		>95% reliable communication	
30		>95% reliable communication	
45		>95% reliable communication	
60		>90% reliable communication	
75		>85% reliable communication	
90		<10% reliable communication	

Table 4: Angle (@ 30cm)

Parameter Value	Actual Performance	Expected Performance	Error
0		>95% reliable communication	
15		>90% reliable communication	
30		>85% reliable communication	
45		>80% reliable communication	
60		<10% reliable communication	

Table 5: Angle (@ 40cm)

Parameter Value	Actual Performance	Expected Performance	Error
0		>80% reliable communication	
15		>70% reliable communication	
30		>50% reliable communication	
45		<5% reliable communication	

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Data Analysis

(To be filled after the test)

Determine appropriate methods for analyzing and presenting the test data (plots, diagrams, tables, etc.). Provide meaningful statistical analysis.

Results and Discussion

(To be filled after the test)

Interpret the results of your test by providing a detailed assessment of the performance and data analysis. Determine whether your tests are successful or not. Deduce meaningful conclusions and determine the next steps.