RFID Technical Instruction

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1 Introduction

RFID technology is utilized in the clinic setting to measure gait speed of geriatric patients. This report provides an overview of the implementation and setup process, detailing each step from the initial installation of hardware components to the integration of software.

1.1 System Overview

The system includes following devices: several tags, one RFID reader, two antennae, one router, and one server (computer). As the connection shown in Fig.1, The system's functional is as follows. An armband containing a tag is placed on the arm of the patient closest to the first antenna. The patient is instructed to walk between the two antennas at their usual speed. The antennas detect the signal from the tag and transmit it to the reader, which processes the signal and sends the data to the router. The router then routes the data to a PC, where the gait speed is calculated. The final result is displayed in a web browser on the PC.

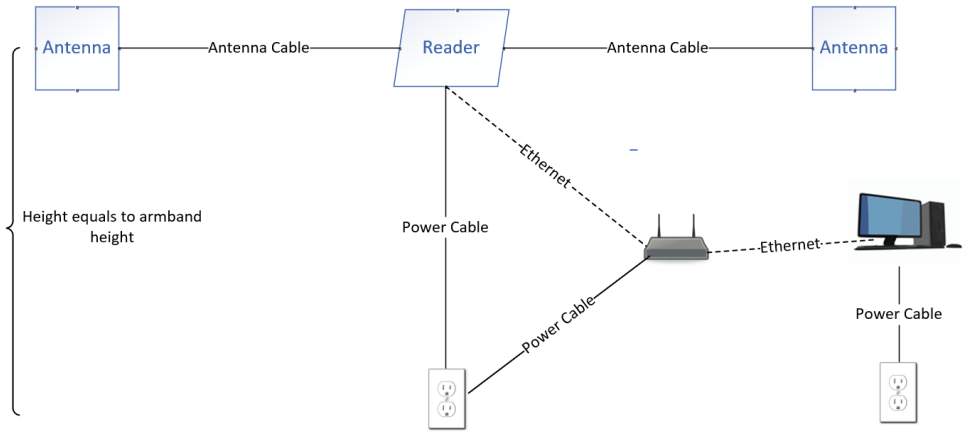

Figure 1: Connections for the system.

2 Hardware

All devices are listed in the *standalone.xlsx*, which is an Excel file including prices and links to purchase.

2.1 Reader

There are four connections made for the reader: two ports for antennas, one power input, and one Ethernet connection (shown in Fig.2). Either antenna can be connected to any available ports, but for compatibility with the existing program's parameters, it is recommended to use ANT2 and ANT3.

2.2 Antenna

Each antenna comes with an attached cable and does not require a separate power supply, as it is powered by the reader once connected. If the antenna cable is not long enough to reach the reader, an extension cable can be used to meet the distance requirement.

Figure 2: Connection to the reader with specified ports.

2.3 Router

Internet access is not needed for this project. The router functions as a switch, bridging data between the reader and the computer. An example connection for the router is shown in Fig.3. One port connects to the reader; one port connects to the computer. Also, a power supply is needed.

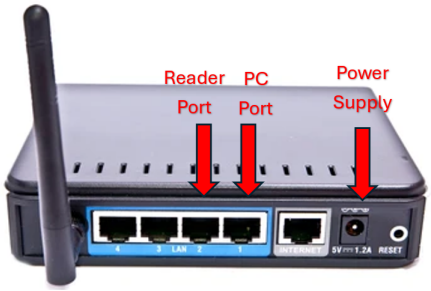

Figure 3: A router connection example.

2.4 Computer

In this project, the computer serves as the main computation unit. It receives data from the reader, calculates the gait speed, and displays the results in a web browser. The computer must be connected to the router via an Ethernet cable for data acquisition.

2.5 RFID tag

When purchasing the reader, some sample tags are included. To customize tags, please contact AtlasRFIDstore.

3 Software

All program, info, and configuration needed for developing the application is saved in github https://github.com/AmyangXYZ/RFID-UI.

3.1 Reader Configuration

The reader, manufactured by Impinj, comes with a manual for setup and initialization. Before configuring, connect the computer to the reader via a router using an Ethernet cable. Two web pages are available for configuring the reader. Enter ”SpeedwayR-14-D3-31” in the browser’s address bar to access the reader’s info page, and enter ”https://speedwayr-14-d3-31/#/configure” to navigate to the configuration page. User name is *root* and password is *impinj*. Note that these addresses are unique to the reader because each reader has its own specific address for accessing its configuration page. Parameters of reader configuration are documented at file 192.168.0.103config.txt.

3.2 Developing Application

3.2.1 Backend

Golang is used in this project as the backend server. It supports concurrent programming through goroutines, which makes it well-suited for handling multiple data streams from the RFID reader in real-time. The server listens for data from the reader, processes the incoming RFID signals, and calculates the gait speed. The processed data is then formatted as a JSON response and transmitted to the frontend application.

3.2.2 Frontend

The frontend application is built using Vue.js, a modern JavaScript framework for building user interfaces. Vue.js integrates seamlessly with Golang by fetching the processed data via WebSocket APIs served by the backend. It then dynamically updates the web interface to display the gait speed results in real-time. The frontend development includes a real-time dashboard showed in the web browser where healthcare staff can view the gait speed of each patient as they pass through the RFID system.

3.3 Generate An Executable

Before generating an executable, the source code needs to be modified to accommodate the new tag IDs. The current testbed has five tags that are hardcoded into the system. To add or update tags, modify the source code with the new tag IDs and ensure they are correctly referenced throughout the program. Once the changes are made, the executable can be generated with the updated configurations

Running On Existing Executable. Assuming all devices are fully connected, copy the Deployment folder to the computer. Double-click *rfid-ui-backend* to start the server. If the server runs successfully, a black window will pop up.

Register New ID Number. This step assumes that all components are fully connected and the system is running on the previous executable. Tap the newly purchased tag on the antenna. The console will then display the ID of the unregistered tag. An example of the console output is shown in Fig.4.

Copy Unregister ID into Backend Program. Copy the 24-digit ID number from the console and replace the old ID in the script *backend/main.go*. An example with five registered tags is shown in Fig.5. The total number of tags does not need to be five; you can register as many tags as needed. Repeat the same process for each tag registration.

Compile Both Backend and Frontend. After tag registration, compile both frontend and backend programs. In the frontend directory, run ”npm run build”. Create two folder, one is called *assets*, another is called *templates*. Copy */dist/assets/index-3e4dfc2c.js*, */dist/assets/index-c114b49a.css*, and */dist/assets/uconn-health-logo-c8ceec0d.png*, into new created *assets* folder. Copy */dist/index.html* into new created *templates* folder. After copying, move two folders *assets* and *templates* into *backend* folder. Then in the backend directory, run ”go build” to compile the backend program.

```
E280689400004401D6E135DC6
please register Tag
E280689400004401D6E135DC6
please register Tag
E280689400004401D6E135DC6
please register Tag
E280689400004401D6E135DC6
please register Tag
E280689400004401D6E135DC6
please register Tag
E280689400004401D6E135DC6
please register Tag
E280689400004401D6E135DC6
please register Tag
E280689400005501D6E13EDC6
please register Tag
E280689400005501D6E13EDC6
```

Figure 4: Output displayed in the console for unregistered ID.

```
TagList = map[string]string{
        "Tag1": "E280689400004401D6E135DC6",
        "Tag2": "E280689400005501D6E13EDC6",
        "Tag3": "E280689400004401D6E13B5C6",
        "Tag4": "E280689400004401D6E136DC6",
        "Tag5": "000000000000000000001088",
}
```

Figure 5: An example with 5 tags registered.

The final files needed for the system are */backend/rfid-ui-backend.exe*, */backend/distconfig.txt*, *templates* folder, and *assets* folder. You can create a folder to hold these necessary files. For example, a folder named *Deployment* is used to organize and store all the required files for easy access and deployment.

Running The System. This step assumes that all components are fully connected. Copy the *Deployment* folder to the computer where you want to run the system. First, double-click *rfid-ui-backend.exe* to start the server. Then, open a web browser and enter the computer's IP address followed by the port number. A valid address would be "server IP address:16311". Now, the system is ready to run can measure gait speed.

4 Other notes

Throughout the development process, several notes were taken that may serve as references for others.

4.1 Antenna Signal Range

The power for the antenna transmitter and receiver needs to be adjusted according to the environment. In a large open space or high interference areas, power may need to be set to a higher level. A discussion on the antenna active zone is in Testing Summary.

4.2 Setting the IP Address for the PC

Since the program is IP address-specific, the computer must use the same IP address consistently. The best way to configure an IP address for a PC is through the router's configuration page. You can assign a specific IP address based on the computer's MAC address, which is a unique identifier for the device.

4.3 Optional Feature: Using a Tablet

The system includes a router, allowing the option to use a tablet to display the output. To operate the system on a tablet, first ensure the server is running on the PC. Then, open the web browser on the tablet and enter ”server IP address:16311” to access the webpage.