NightWatcher Sleepwalker Detection System - User Manual

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1 Introduction

The NightWatcher Sleepwalker Detection System is designed to monitor sleepwalking episodes and provide real-time tracking and alerts. The system consists of three core components: a wearable device, a stationary monitoring system, and a mobile rover. These components work together to detect movement, track

sleepwalkers, and alert caregivers through the Telegram messaging app. This guide will help you set up and operate the system effectively.

2 System Requirements

To use the NightWatcher system, ensure you have the following components:

2.1 Hardware Requirements

- 1 Wearable Device (Raspberry Pi with speaker, microphone, and IMU)
- 1 Stationary Device (Raspberry Pi with Raspberry Pi Camera and speaker)
- 1 Rover (Raspberry Pi, Raspberry Pi Camera, ESP32 Microcontroller, Rover Vehicle)

2.2 Software Requirements

- Create a Tailscale account (on a computer or mobile phone)
- Telegram App (installed on the caregiver's mobile phone)
- Download RealVNC Viewer on a computer

3 Setup and Installation Instructions

3.1 Check If You Have All Components

Ensure you have:

- Wearable Device (1 RPi)
- Stationary Device (1 RPi)
- Rover (1 RPi)

3.2 Download the Required Software

- Create a Tailscale account on any device and join these invite links to get connected to the devices:
  - `https://login.tailscale.com/admin/invite/bwxZHjh88hK`
  - `https://login.tailscale.com/admin/invite/GL2K28WJKsh`
  - `https://login.tailscale.com/admin/invite/s7ku2Tf3qP7`
- Download the Telegram app on your caregiver's mobile phone.
- Download RealVNC Viewer on your computer.

3.3 Set Up Each Component on the Computer

Username: `pitank`
Password: `123456789`
All credentials of the Raspberry Pis are the same.

3.3.1 Information Needed From Tailscale

After successfully accepting the Tailscale invite links to get all 3 devices of the Nightwatcher connected to your account, please note the **unique IP addresses** provided by Tailscale for each device.

3.3.2 Main Processor Device Setup

1. Open RealVNC Viewer and connect to `mainserverpi` with the IP address provided by Tailscale.
2. In the terminal, enter:

```
cd ECE_180/Team4/RPi_Main_Processor
python main.py
```

3.3.3 Wearable Device Setup (Speech Processor, IMU)

1. Connect the Raspberry Pi to the battery source included in the sleeve.
2. Open RealVNC Viewer and connect to `pifall` with the IP address provided by Tailscale.
3. Have a USB Microphone and USB Speaker connected to the wearable device Raspberry Pi.
4. **Install Dependencies (if not installed)**:

```
pip install speechrecognition requests edge-tts \
            langchain langchain_groq groq pydantic
```

5. Ensure the microphone and speaker are connected to this Raspberry Pi.
6. Open two terminal windows in RealVNC.
7. In the first terminal:

```
cd BerryIMU/fallberry
python mainimu.py
```

8. In the second terminal:

```
cd BerryIMU/fallberry
python speechpi.py
```

9. Activate NightWatcher by speaking into the microphone and saying:

   `"Hey Watcher"`

3.3.4 Rover Setup (Autonomous Driving, Object Detection)

1. Ensure the Rover car and the raspberry pi embedded on the Rover is both powered on and connected to the network.
2. for the ESP32 Microncontroller, make sure that connections are properly installed so that the Derivate Control Drive is properly configured with the script `motor.py`
3. **Install Dependencies (if not installed)**:

   ```
   pip install opencv-python numpy pyserial
   ```

4. Create or verify the folder structure on the Rover's Raspberry Pi containing:
   - cam_CPU.py
   - receiver.py
   - motor.py
   - main.py
   - Object_Detection _Files
     - coco.names
     - frozen_inference _graph.pb
     - ssd_mobilenet_v3_large_coco_2020_01_14.pbtxt

   These files enable object detection using the SSD MobileNet model in OpenCV.
5. Connect to the Rover's Raspberry Pi using its Tailscale IP address:

   ```
   ssh pitank@<ip_address_tailscale>
   ```

6. Enter the password when prompted.
7. Run the following commands within desired folder, for example we will the call the folder contaning the rover codes called Activation_Rover:

   ```
   cd Activation_Rover
   sudo python3 main.py
   ```

4 User Interface Overview

- The NightWatcher system is controlled via voice commands and a Telegram chatbot.
- The Telegram bot (@NightWatcher4bot) is used to send and receive alerts.
- Speech commands allow activation and deactivation of tracking.
- The RealVNC Viewer enables manual access to Raspberry Pis for troubleshooting.

5 Specific Features

5.1 Set Up Connection to NightWatcher on Phone

1. Open Telegram and create a new chat with `@NightWatcher4bot`.
2. Send the following command:

   ```
   /SetChatID
   ```

3. Give the phone with Telegram access to a trusted caregiver.

5.2 Get Real-Time Camera Feeds via Telegram Message

- Send the following command to get a screen capture from the main camera:

  ```
  /MainCam
  ```

- Send the following command to get a screen capture from the rover's camera:

  ```
  /GetCamRover
  ```

5.3 Set Up the NightWatcher in Your Bedroom

- Position the Stationary Device camera towards the bed.
- Ensure you are within the camera's field of vision.
- Set up the Rover's camera facing the bed.
- Wear the Wearable Device on your forearm.

5.4 Using the System

1. Get in bed.
2. The system runs continuously.
3. Say: `"Hey Watcher"` *(wait for a response)* `"Deactivate"` when waking up to prevent false alarms.
4. Reactivate the system upon returning to bed: `"Hey Watcher"` *(wait for a response)* `"Activate system"`.
5. Say: "Goodbye, Watcher," to shut down the system.

6 Known Issues and Troubleshooting

Issue	**Solution**
Cannot connect to RPi via RealVNC	Ensure Raspberry Pi is powered on and connected to Wi-Fi.
Telegram bot does not respond	Restart the `main.py` script on the Main Processor Device.
Speech commands not recognized	Ensure the microphone and speaker are functioning.
Rover is not moving	Check if the Rover is activated and receiving UDP commands.
The alarm goes off repeatedly	Make sure the main camera is facing towards the user.

7 Enjoy Using NightWatcher!

Sleep with peace of mind knowing NightWatcher is actively monitoring and ensuring your safety.