Watchdog
An Intelligent Procedure Tracker
Members

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IKEA JOB INTERVIEW

Please have a seat
Motivation
Up to 40 minutes...
Goal
Goal

To verify an astronaut's accuracy to standard operating procedure
Introduction

Solution
Problem Specification

PCB embedded glove (Motion/Tool detection)

LCD display with 3D-printed case

Computer Vision powered Body-mounted camera

NFC tags embedded tool

Solution

TX2 and power supply inside the backpack
Hardware Overview
Nvidia Jetson TX2

- ARMv8 (64-bit) Multiprocessor CPU Complex
- 256 core Nvidia Pascal GPU
- Power Requirement: 5.5 V - 19.6 V
- Interfaces: I2C, HDMI, USB, UART, SPI
- Connectivity: Bluetooth, WiFi

- Powerful On-board Computer
Bluetooth Beacon (Transmitter)
- One-way Bluetooth Low Energy signal transmitter
- Range of transmission: 1 m (expected)
- Localization
- Embedded in marker

On-Board Bluetooth Unit (Receiver)
- On-board Bluetooth Version 4.1
- Custom function to translate Beacon signal to distance
Camera

- Logitech C270 HD Webcam
- Interface: USB
- Record videos of objects

- Neural Network powered Computer Vision
**LCD Touch Screen**

- 5 inch LCD touch screen
- Power Requirement: 5 V via Micro-USB
- Interface: HDMI
- Display tasks and errors

**Wrist Mounted Touch Screen LCD**
Inertial Measurement Unit

- BNO055
- 9 Degree of Freedom
- Memory - mapped addressing to specify sensor
  Allowing for reading specific data
- Interface: I2C
- Accelerometer & Gyroscope
  - Analyze data to determine hand movements
    such as hammering and etc.
Near Field Communication

- PN532
- Range of transmission: 10 cm
- Interface: I2C
- Recognize a unique tag when it is closed to the chip
- Detect current using tool
  - NFC chip embedded in glove,
  - tags embedded in tools
- Hand Orientation and Motion Tracking Glove
- Tool Detection and Identification Glove
Printed Circuit Board

- A combination of NFC and IMU
- Challenges
  - Minimize the size
  - Design and tune the antenna
- 4 layers PCB
  - 1st layer: SMT components
  - 2nd & 3rd layer: internal connections
  - 4th layer: NFC antenna
Software Overview
Problem Specification

Software

Task Manager

- current task: N
- task status: P/WIP/E
- information: "no error"

If correct:
status WIP->P

If not:
status WIP->E, error information & REDO

Default action for each task
......

compare and check

Action result receiving from Recognizer

Recognizer

UI
Action Recognition
Algorithm
Task 1 → Task 2
Task 1
Task 1

Software
Recognizer

Diagram showing a complex network of interactions between different components labeled 'G' with arrows indicating flow or relationship between them.
Task 1 → Task 2
Problem Specification

Software

User Interface

Green -- “Done”
Grey -- “Waiting”
Yellow -- “In-progress”
Red -- “Warning”

To switch task:
- Click “previous” or “next” button to the adjacent task.
- Click “task list” to another interface so that the user can select one task and go to that task.
Current Task Detail:

1. Use the body camera to search samples;
2. Use the body camera to identify those target samples;
3. Use the hammer to collect some samples.

Task 6

Take some samples using the hammer...

Completion Check:

Working Status:
Warning

The End

- Task detail interface (upper left)
- Main interface, when working status is warning, indicates user’s action is out of accord with that described in task.(upper right)
- The final interface (lower left) allows user to review each task and check the progress.
Demonstration Video
1. Place the plastic marker and approach the expected site.

2. Lay down the stick on the ground.

3. Take pictures of the stick on the ground.

4. Use the probe thermometer to measure the temperature of target point.

5. Use the Barometer to measure the air pressure of target point.

6. Use the hammer to take some samples.

7. Leave the current position and go to the next position.
Special Thanks to...

Dr. Yogananda Isukapalli
Carrie Segal
Brandon Pon

Dr. Jessica Marquez
Dr. Richard Joyce

and

UC SANTA BARBARA engineering

NASA

Qualcomm

Acknowledgements