



जय हिन्द



T.R.A.C.E

TACTICAL RECONNAISSANCE AND COMMUNICATION EQUIPMENT



T.R.A.C.E



PROBLEM STATEMENT

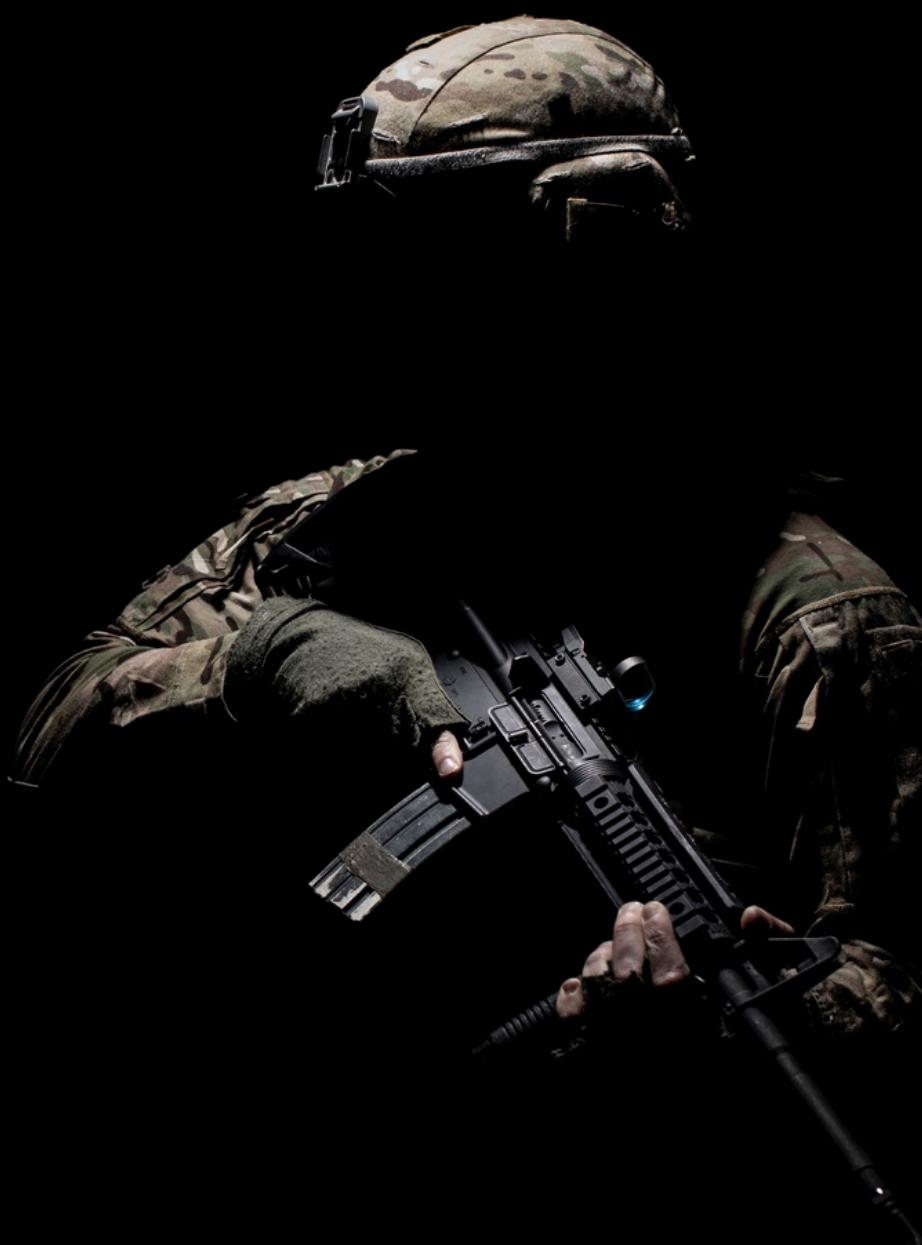


SIH1772:
LIVE LOCATION TRACKING



PROBLEMS:

1. LACK OF PRECISE AND TACTICAL
LOCATION
2. REAL TIME 3D INTEGRATION



T.R.A.C.E



NEED AND ONGOING RESEARCH

Army Envisions Global 3D Terrain Map As Future PNT Aid For Operations

Brig. Gen. William Glaser, head of the Army's Synthetic Training Environment effort, said his team is "very proud" of One World Terrain because it "really just started off as an idea within the simulations community, but it's expanded out significantly into the operational community."

IJCRT.ORG **ISSN : 2320-2882**

 **INTERNATIONAL JOURNAL OF CREATIVE
RESEARCH THOUGHTS (IJCRT)**
An International Open Access, Peer-reviewed, Refereed Journal

**REAL-TIME EMBEDDED LOCATION
TRACKING AND HEALTH MONITORING
SYSTEM FOR SOLDIERS**

Dr. M. Girish Kumar¹
Associate Professor, Dept. of Electronics & Communication Engineering.
TKR College of Engineering & Technology, India.

T. Bindhu², V. Sri Datta Murthy³, V. Nishanth⁴
Dept of Electronics & Communication Engineering.
TKR College of Engineering & Technology, India.

Modernisation of armed forces: Military survey and GIS

By Lt Gen PC Katoch PVSM, UYSM, AVSM, SC (Retd) - 07/25/2013 9 Minutes Read

<< Military Survey is responsible for providing the forces with maps of border areas. The author argues that not only is the agency not focussing on its primary task, but is also continuing to use outdated methods and technology to prepare maps... >>



DELIVERABLES



PRESENTED

SUPPORTING HARDWARE

1. LIVE LOCATION TRACKING	• SPEKTOR NODES • GATEWAY NODE • BLE TAGS
2. ROOM & FLOOR WISE 3D MAPPING	• UWB LOAD BASED ARMBAND
3. LIVE HEALTH PARAMETER TRACKING	• SENSORS (ADA232 & NH-ET)
4. FRIEND-FOE DETECTION SYSTEM (Current Status: Demo ✓)	• GYRO (To Be Placed on The Weapon.) • SPEKTOR MODULE
5. RL BASED CHASE OPTIMIZER (Current Status: Output achieved on graph ✓. Integration with Blender left.)	

FUTURE PROSPECTS



ROUND-1



PRESENTED

READY : UWB
COMMUNICATION

SHOWN :

- PPT AND THOROUGH UNDERSTANDING OF OUR VISION
- 3D RENDERED MODEL WITH DRAG AND DROP FEATURE AND DYNAMICALLY SORTING LIST OF SOLDIER DATA

SUGGESTIONS

SHOWED CONCERN ABOUT OVERHEAD FOR PREINSTALLED STATIC NODES INSIDE BUILDING

IMPROVEMENTS

1. WE MADE GENERIC HARDWARE WHICH CAN BE DEPLOYED “ON THE GO” AND STATICALLY PRE INSTALLED AS WELL , GIVING THEM FLEXIBILITY AND MINIMUM OVERHEAD



ROUND-2



PRESENTED

READY :

- INTER FLOOR COMMUNICATION USING SPEKTOR NODES AND ID CARDS
- Vital Health parametering, Unidentified person monitoring

SHOWN :

3D RENDERED MODEL WITH DRAG AND DROP FEATURE AND DYNAMICALLY SORTING IST OF SOLDIER DATA

SUGGESTIONS

- CONCERN ABOUT THE OBSTRUCTION, REFLECTION, DIFFRACTION CAUSED BY WALLS AND DIFFERENT OBJECTS OF THE BUILDING
- ENLIGHTENED US ABOUT BETTERING OUR LOCATION TRACKING SYSTEM IN 2D PLANE (X,Y COORDINATES)

IMPROVEMENTS

- 1. WE SWITCHED TO USE TOF(TIME OF FLIGHT) FOR DETERMINING THE RANGE INSTEAD OF RSSI, THIS IMPROVED THE PROBLEM CAUSED BY OBSTRUCTIONS.
- 2. WE STUCK TO OUR “ON THE GO” DEPLOYMENT APPROACH, WE INTEGRATED GA50 SENSOR () FOR DEAD RECCONING ON THE FLOOR, USING SLAM FOR APPROXIMATION OF LOCATION FROM MULTIPLE SPEKTOR NODES.

TIMELINE



NOW



TOM
MORNING



TOM
EVENING

INTERFLOOR LOCATION ✓

TARGET:

- Unidentified Person Detection.
- Health Monitoring



TARGET:

- Friend-Foe detection system
- Reinforcement Learning based Chase Optimizer

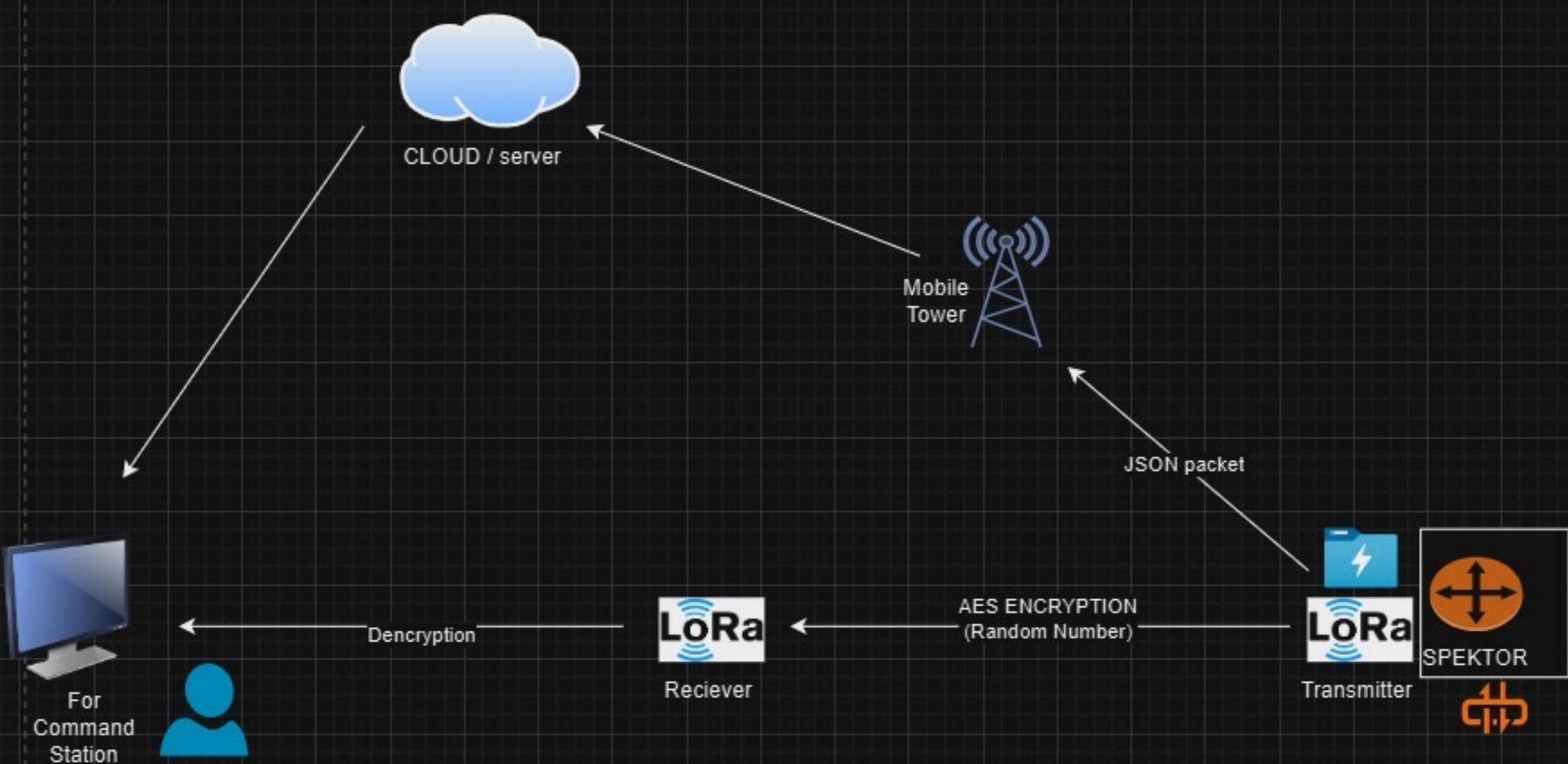


SOFTWARE DEPLOYMENT



- **LIVE SOLDIER DATA MONITORING AND LOCATION MAPPING**
- **S.L.A.M & M.I.M.O**
- **RL BASED ROUTE OPTIMIZER**

APPROACH



T.R.A.C.E

COMMAND CENTRE'S DASHBOARD UI



T.R.A.C.E

About us Contact us More

SOLDIER LIST ML BASED MIV 1 MIV 2

TAG NO.	SOLDIER LIST	ML BASED	MIV 1	MIV 2
1A223	SOLDIER 1	<div style="width: 100%;">██████████</div>	167	68
1C334	SOLDIER 2	<div style="width: 100%;">██████████</div>	125	83
2A76F	SOLDIER 3	<div style="width: 100%;">██████████</div>	163	65
1B345	SOLDIER 4	<div style="width: 100%;">██████████</div>	169	70
1C458	SOLDIER 5	<div style="width: 100%;">██████████</div>	127	85
1A489	SOLDIER 6	<div style="width: 100%;">██████████</div>	121	82
1B985	SOLDIER 7	<div style="width: 100%;">██████████</div>	125	88
2A678	SOLDIER 8	<div style="width: 100%;">██████████</div>	120	81
4A123	SOLDIER 9	<div style="width: 100%;">██████████</div>	174	63
3B567	SOLDIER 10	<div style="width: 100%;">██████████</div>	129	89

SOLDIER 1

ALERT ⚠

Location: Floor : 2
Nearest Tag ID: 4a123
Precise: 30.276 SE of TAG 4a123

Name: Maulik Gupta (1A223)
ML Based Vital Evaluation: 89% Critical
Vitals: SpO2- 68
Heart Rate- 167
Location: Floor : 2
Nearest Tag ID: 4a123
Precise: 30.276 SE of TAG 4a123

Live Plot:

SOLDERS TO BE RESCUED

Title	Description	9:41 AM
Title	Description	9:41 AM
Title	Description	9:41 AM

DISABLE EQUIPMENT

T.R.A.C.E

COMMAND CENTRE'S DASHBOARD FRONTEND

The screenshot displays the T.R.A.C.E Command Centre's Dashboard Frontend. At the top left is a rifle icon, and at the top right is another rifle icon. The dashboard features a dark mode toggle switch in the top right corner.

Location: A large section on the left shows a 3D cylindrical map with a red dot indicating a soldier's location. A callout box labeled "Soldier Details" provides information for "Soldier 1": Name: Soldier 1, Floor: 7, Status: Active. A "Close" button is present in the callout box.

Soldier Status: A table titled "Soldier Status" shows the following data:

Name	ID	Floor	Status
Soldier 1	287945	Floor 3	Alive
Soldier 3	377894	Floor 2	Not Responding
Soldier 5	589123	Floor 5	Not Responding
Soldier 8	891245	Floor 7	Not Responding
Soldier 2	135135	Floor 1	Injured

Soldier 3 - Detailed Profile: A detailed profile for "Soldier 3" is shown, including:

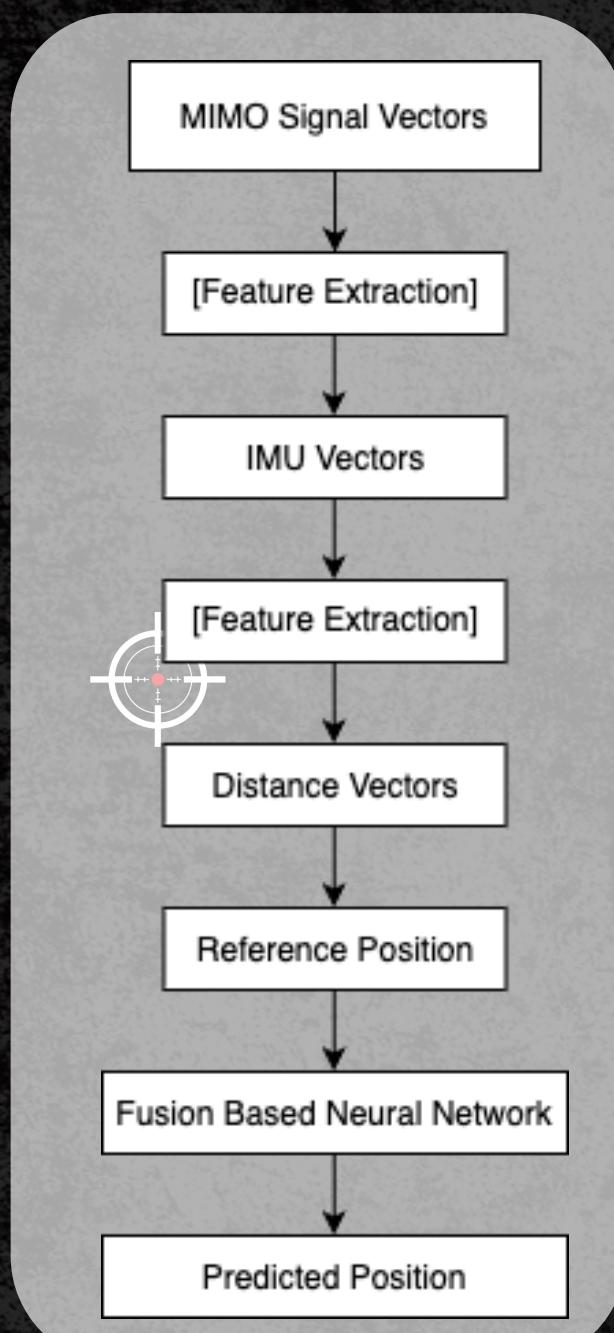
- Name: Soldier 3
- ID: 377894
- Role: Medic Specialist
- Floor Number: Floor 2
- Age: 32
- Date of Joining: 2016-03-10

Push Notifications: At the bottom left, a notification from "SnoreToast" states "Security Alert Unidentified person detected!"

→ LIVE 3D
MAPPING

→ SOLDIER
DETAILS

→ PUSH NOTIFICATIONS



SLAM & MIMO

S.L.A.M

(Simultaneous Localization and Mapping)

- A computational technique used to map an unknown environment while simultaneously tracking an agent's location within it.
- Fuses sensor data like IMU, LiDAR, and cameras to estimate position and construct the environment map.

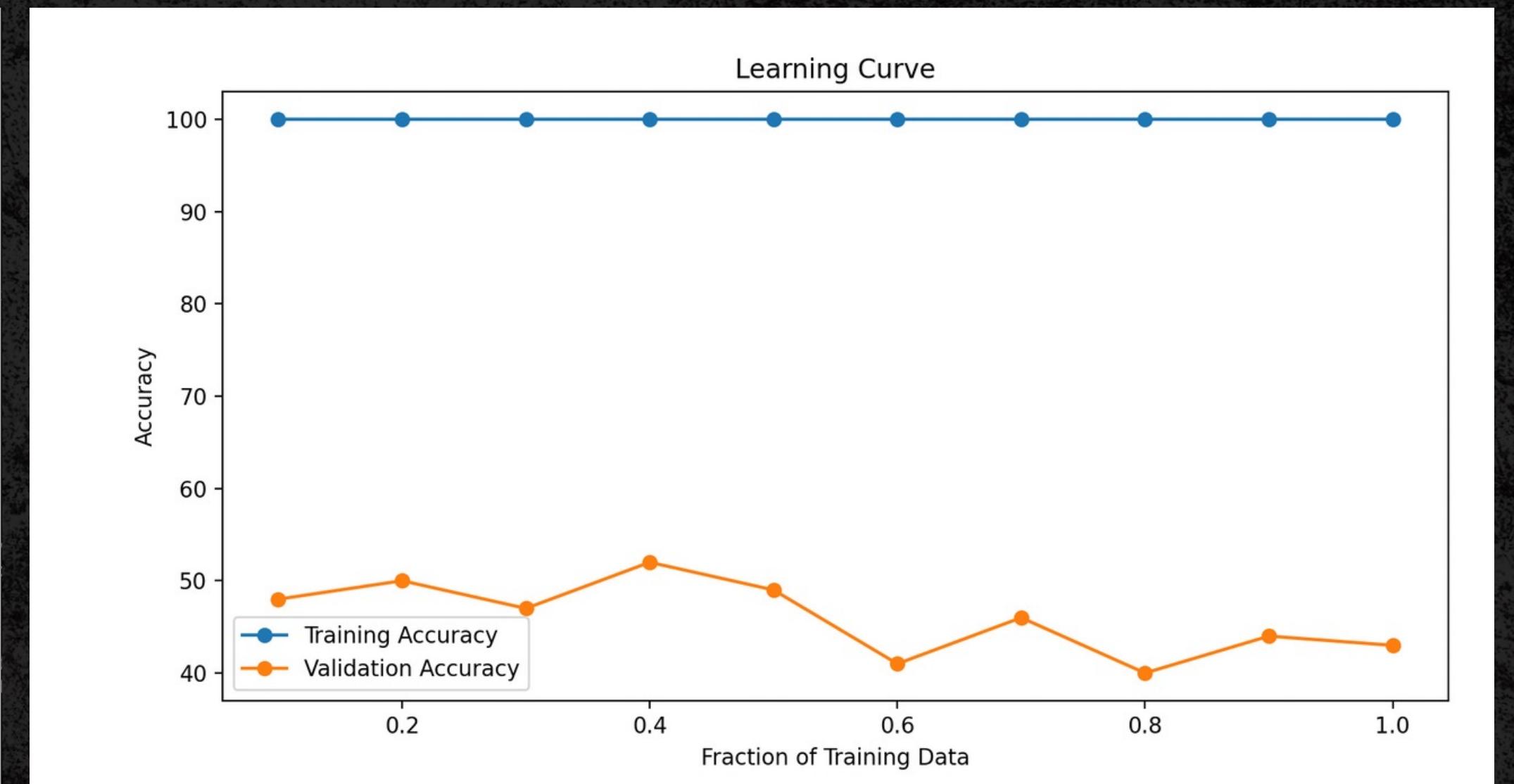
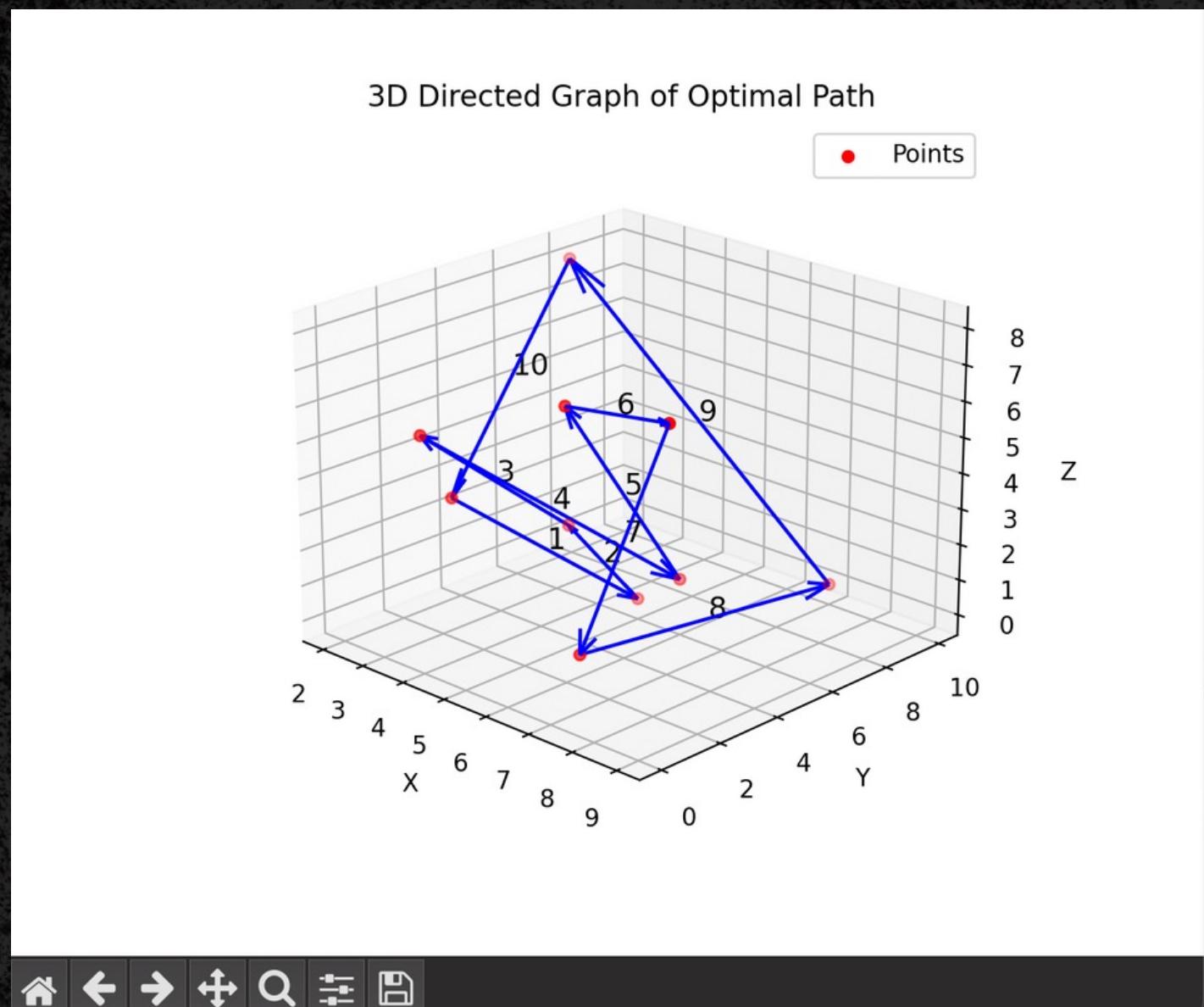
M.I.M.O

(Multiple Input Multiple Output)

- A communication technology that uses multiple antennas at both the transmitter and receiver to increase data rates and improve spatial localization.
- It leverages spatial diversity to estimate parameters like Time of Flight (ToF) and Angle of Arrival (AoA).



RL BASED ROUTE OPTIMIZATION



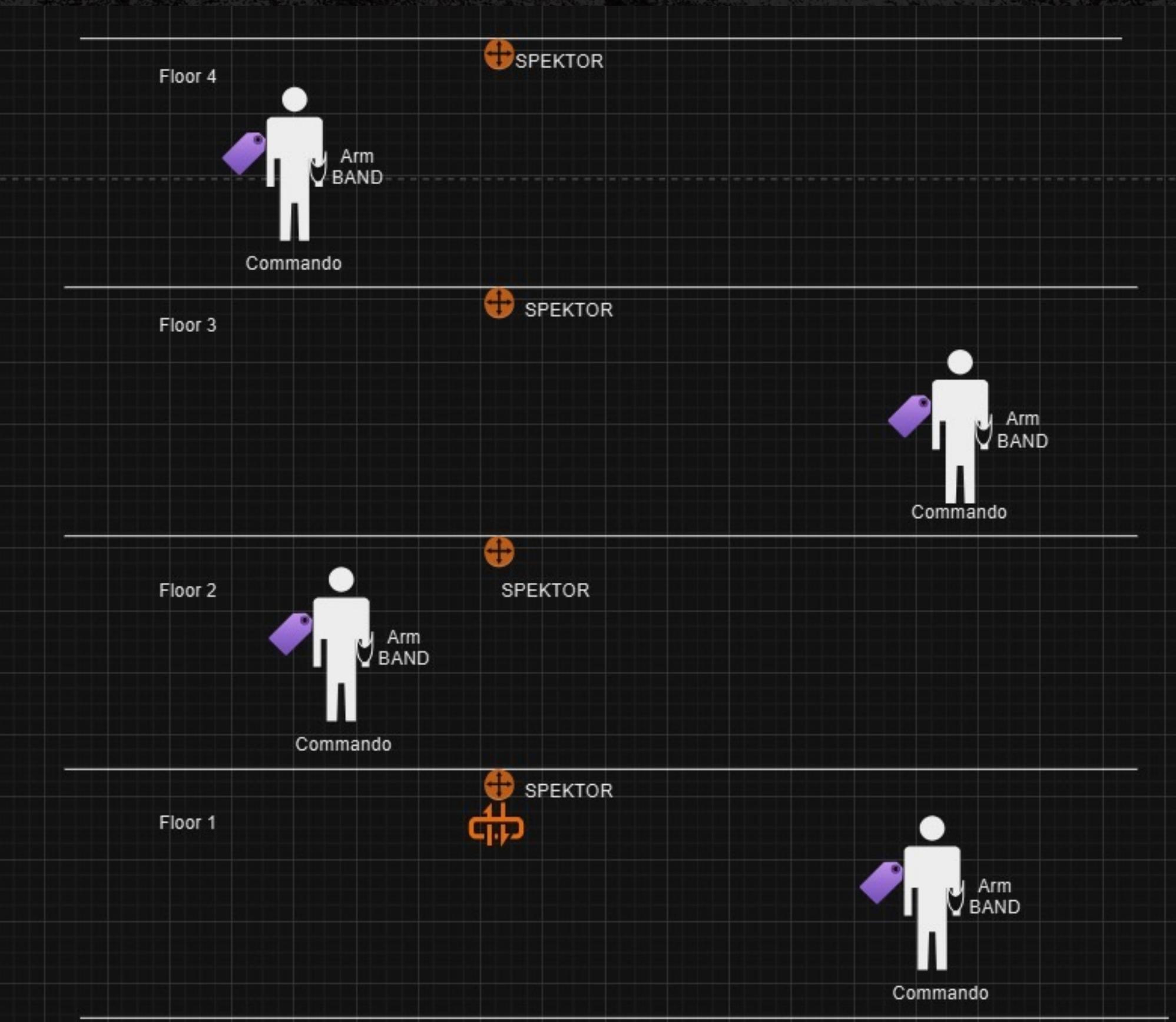
T.R.A.C.E

HARDWARE DEPLOYMENT



THE NEW PARLIAMENT OF INDIA,
NEW DELHI

T.R.A.C.E

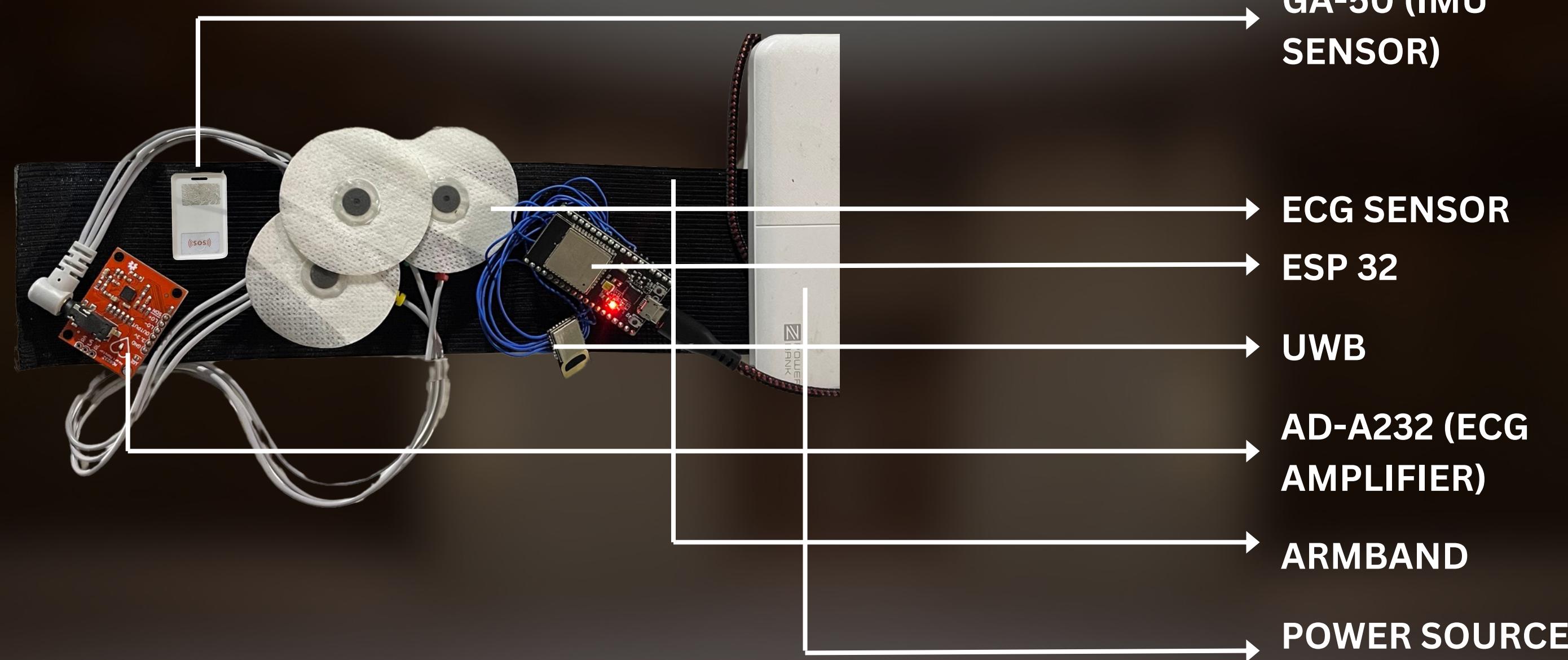




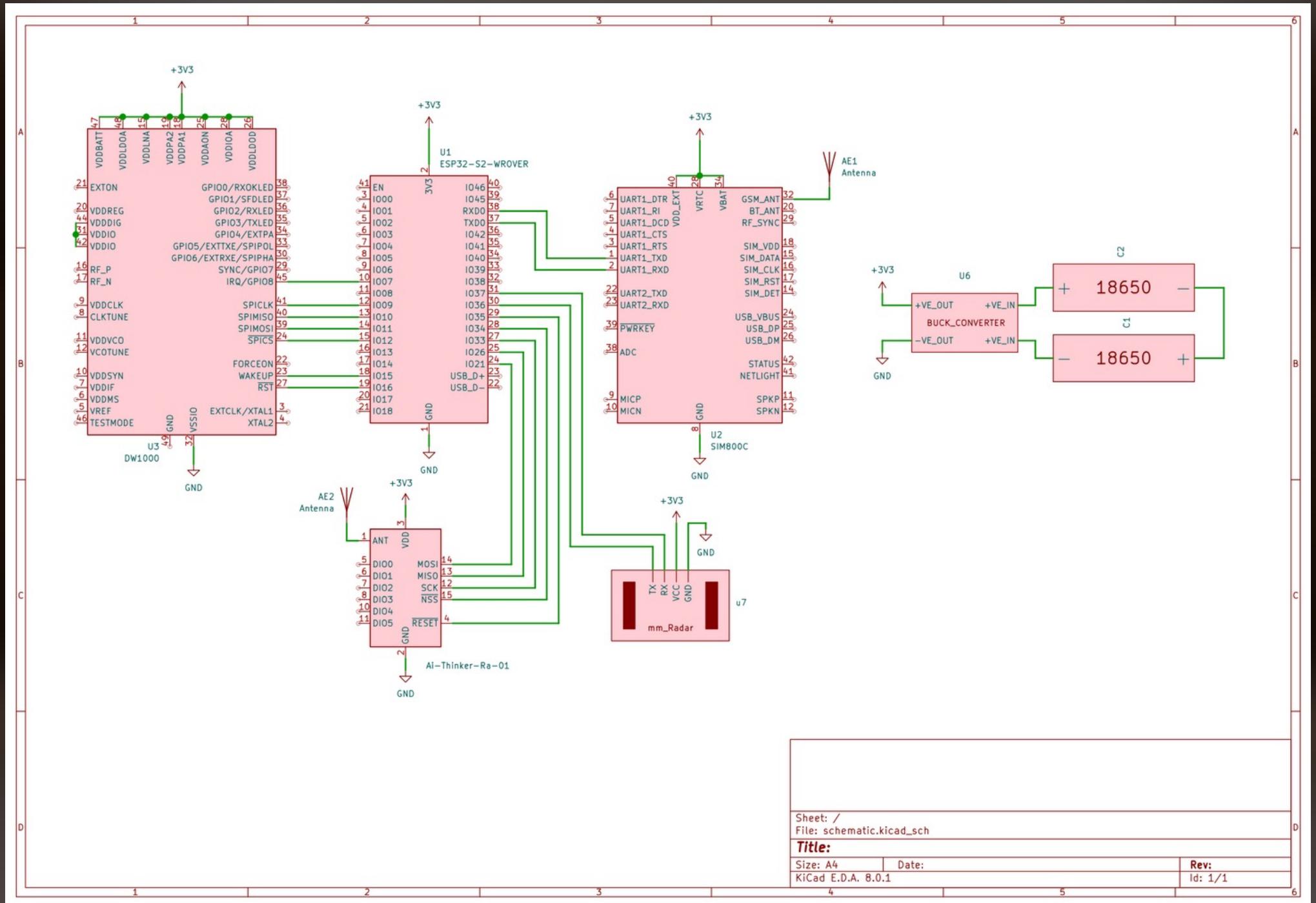
ARMBAND

- Every soldier is given an Armband equipped with the supporting hardware.
- IMU (Accelerometer + Gyroscope) is used to enhance the location accuracy.
- UWB helps in precise 3D location across floors.

ARMBAND ASSEMBLY



ARMBAND SCHEMATIC



SPEKTOR MODULES

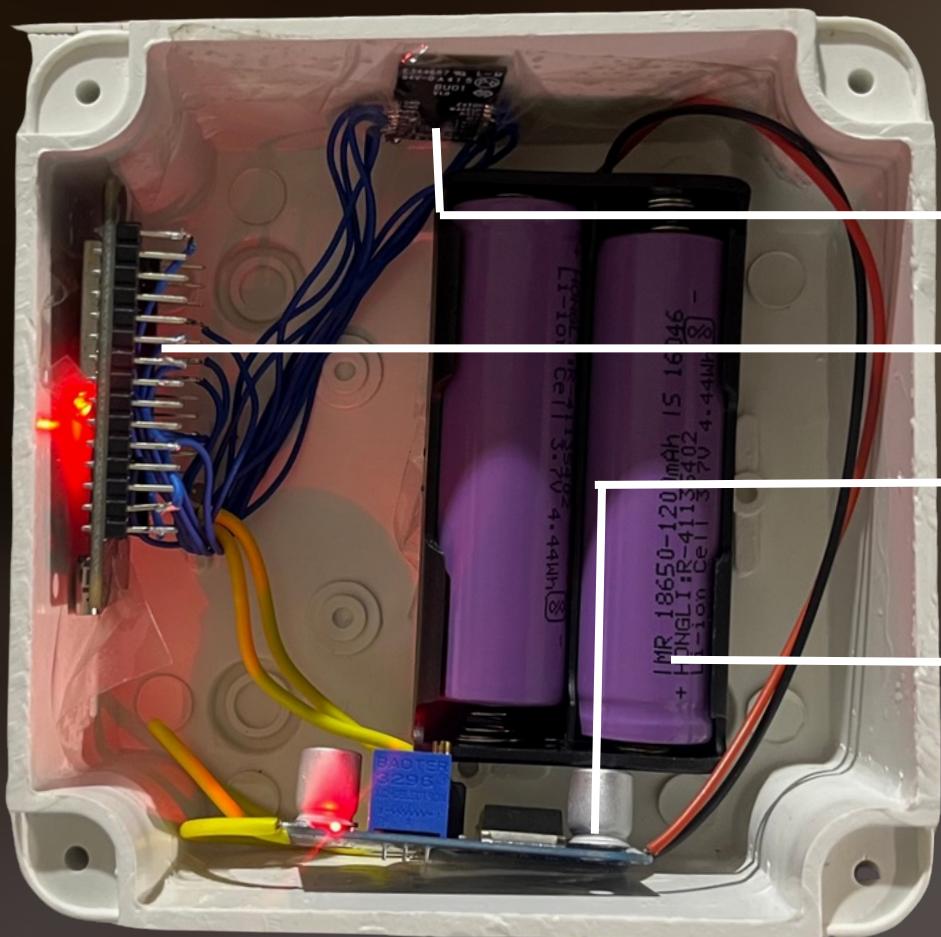
TO CREATE MESH
FUNCTION: FRIEND/FEED DETECTION
NETWORK TO TRANSMIT
DATA TO THE MASTER
GATEWAY NODE.



MODULE ASSEMBLY



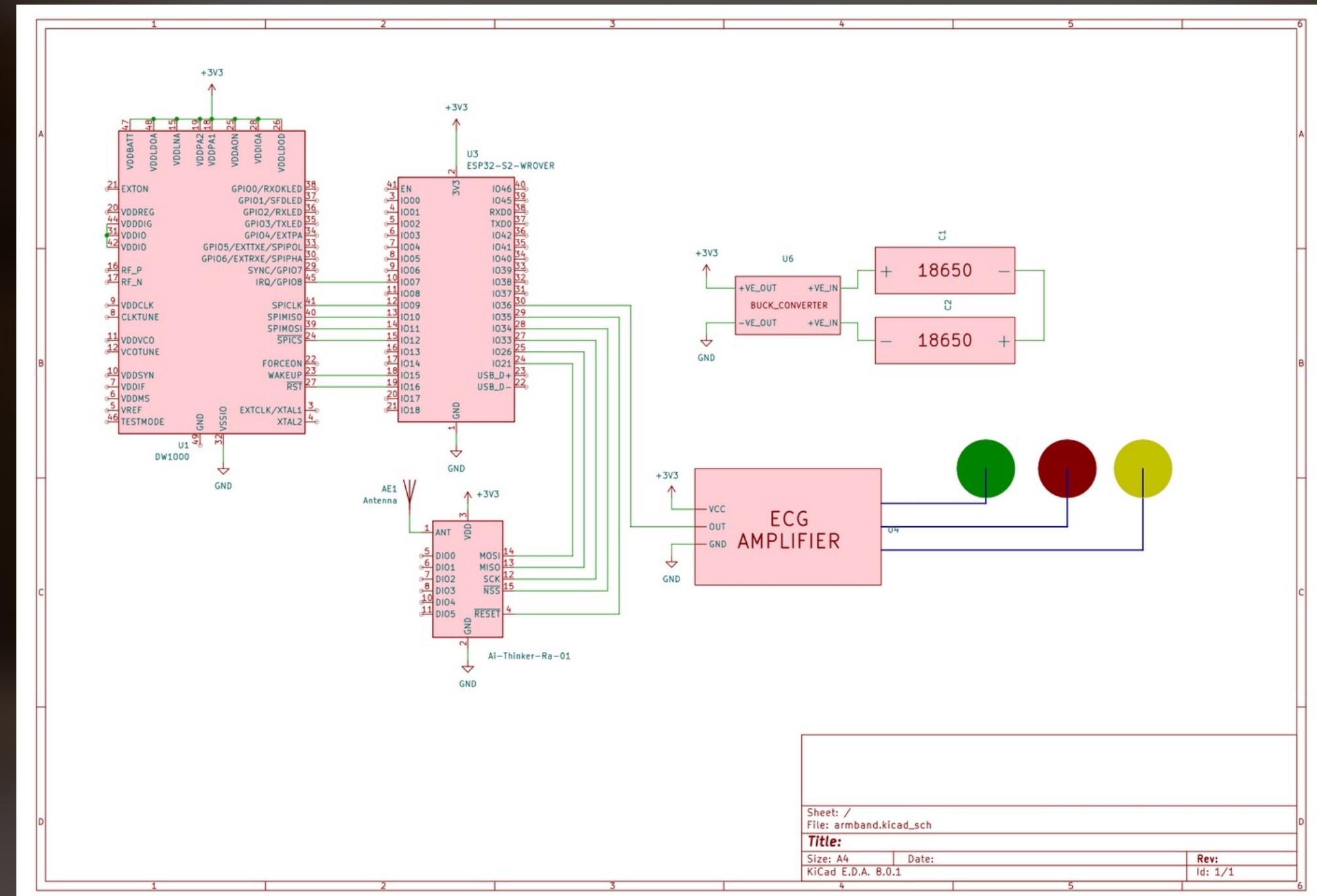
GATEWAY NODE



MM WAVE RADAR ←
UWB
ESP32
BUCK CONVERTER
BATTERY (POWER SOURCE)



MODULE SCHEMATIC



USP OF OUR MODULE



1 PRODUCT, 2 POSSIBLE DEPLOYMENTS

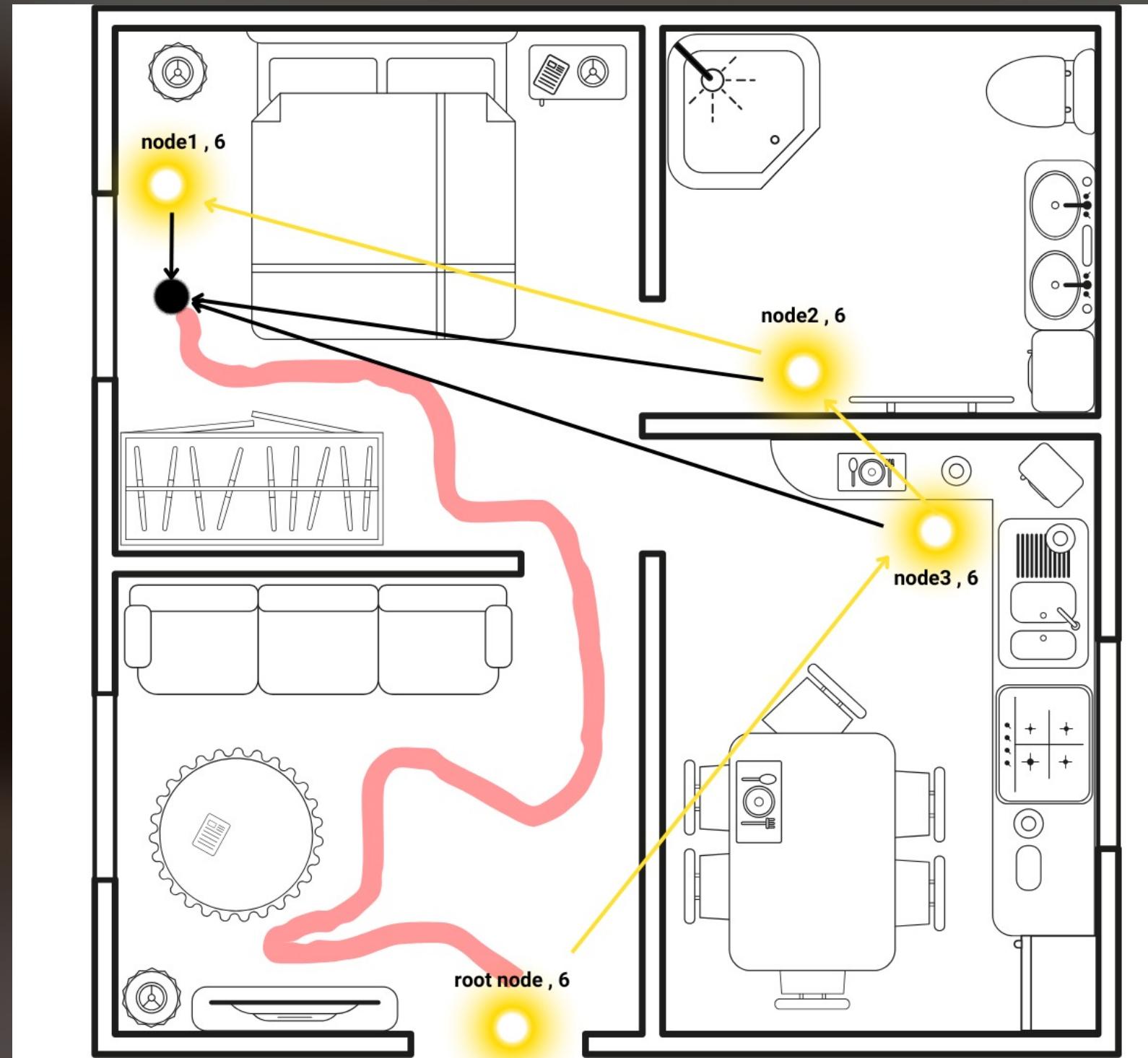
DEPLOYMENT 1:

Pre-Install the module on each floor of the building.

DEPLOYMENT 2:

- Throw a module with a reference number at each floor.
- Gateway module for the entrance is colour coded.

WORKING OF IMU





HOW WE STAND OUT FROM OTHERS TRYING IN MARKET ?

- ⦿ **WHY NOT USE BLE FOR A PRECISE LOCATION TRACKING?**
 - RSSI Index of UWB is much better than BLE.

- ⦿ **WHY NOT USE WIFI INSTEAD OF SPEKTOR MODULES?**
 - Power and network supply in most operations are turned off. Hence, Equipments have been designed considering the worst circumstances.

- ⦿ **WHY NOT USE A SIMPLE GPS?**
 - Gives just a 2D plotting, and enables use of public network. We totally depend on our own mesh networks. Aids privacy.



HOW WE STAND OUT FROM OTHERS TRYING IN MARKET ?

- WHY NOT JUST USE THE INFAMOUS ACCELEROMETERS?
 - Seemingly dead reckoning using very high precision accelerometers attached to soldiers seems the best solution, but in real life it is impossible to get hardware of this much accuracy.

- WHY NOT USE RFID TAGS?
 - RFID Tags work only in line of sight & Power hungry transcievers.

- WHY NOT USE ALTIMETERS?
 - Not reliable due to unexpected changes in weather and envoironment during the operation.

**THANK
YOU**

