

# Smart Cabinet

## Problem Statement

- Daxsonics use expensive cables that can take months between ordering and receiving
- Further if a recall or issue with certain cables was later discovered knowing what products included these cables is essential
- As with many companies inventory tracking is currently done manually and prone to errors
- We are to design a smart cabinet for cable tracking and inventory control for Daxsonics Ultrasonics Inc.



Example cable packet

## Objectives

- System must detect and track serial numbers of cables entering and leaving the smart cabinet
- System must associate metadata to cable serial numbers
- System must provide traceability regarding user updates and cable information

## Design Process

- Three scanning options were considered

Hardware	Method	Pros	Cons
Camera	QR codes or visually ID objects	Versatile	Line of sight, Complex solution
RFID (Radio-Frequency ID) tags	Wireless RF scanner	Track multiple objects simultaneously, Versatile, Reusable	Tags must be maintained, Cost
Barcodes	Laser scanner	Simple, Cheap	Line of sight, Not automated

- RFID tags best match requirements
- RFID frequency had to be selected

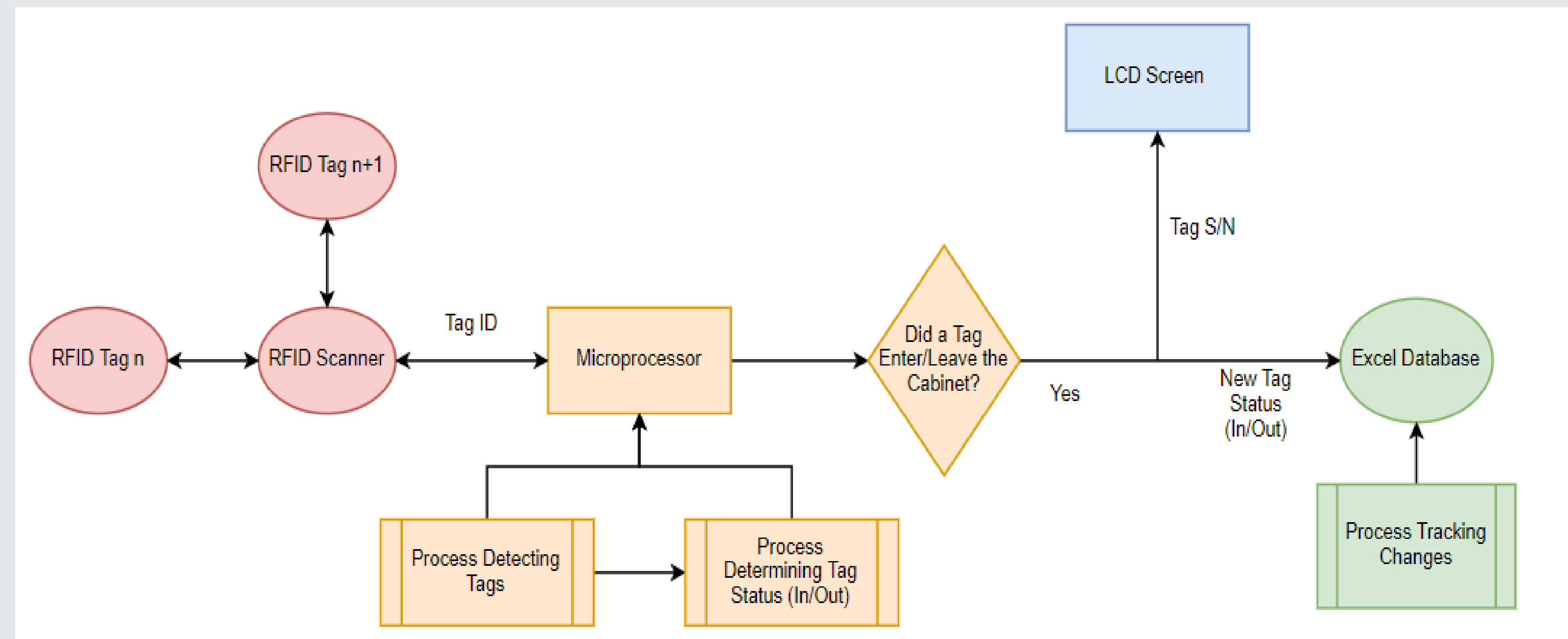
Tag Type	Tag Frequency	Detection Range	Price per Tag	Which One?
Low	30kHz - 300kHz	Contact	\$0.70 - \$20.00	Range is too Small
High	13.56 MHz	30cm	\$0.35 - \$10.00	Good Range (Covers Cabinet shelf)
Ultra-High	300MHz - 3GHz	30m - 100m	\$20.00 - Beyond	Expensive Tags, Range Overkill

## Details of Design

- Proposed system uses an RFID scanner to track packages containing cables through RFID tags and relays distance information concerning the package to database. Database contains metadata for each individual cable (S/N, Associated Project, In the cabinet?, etc...)

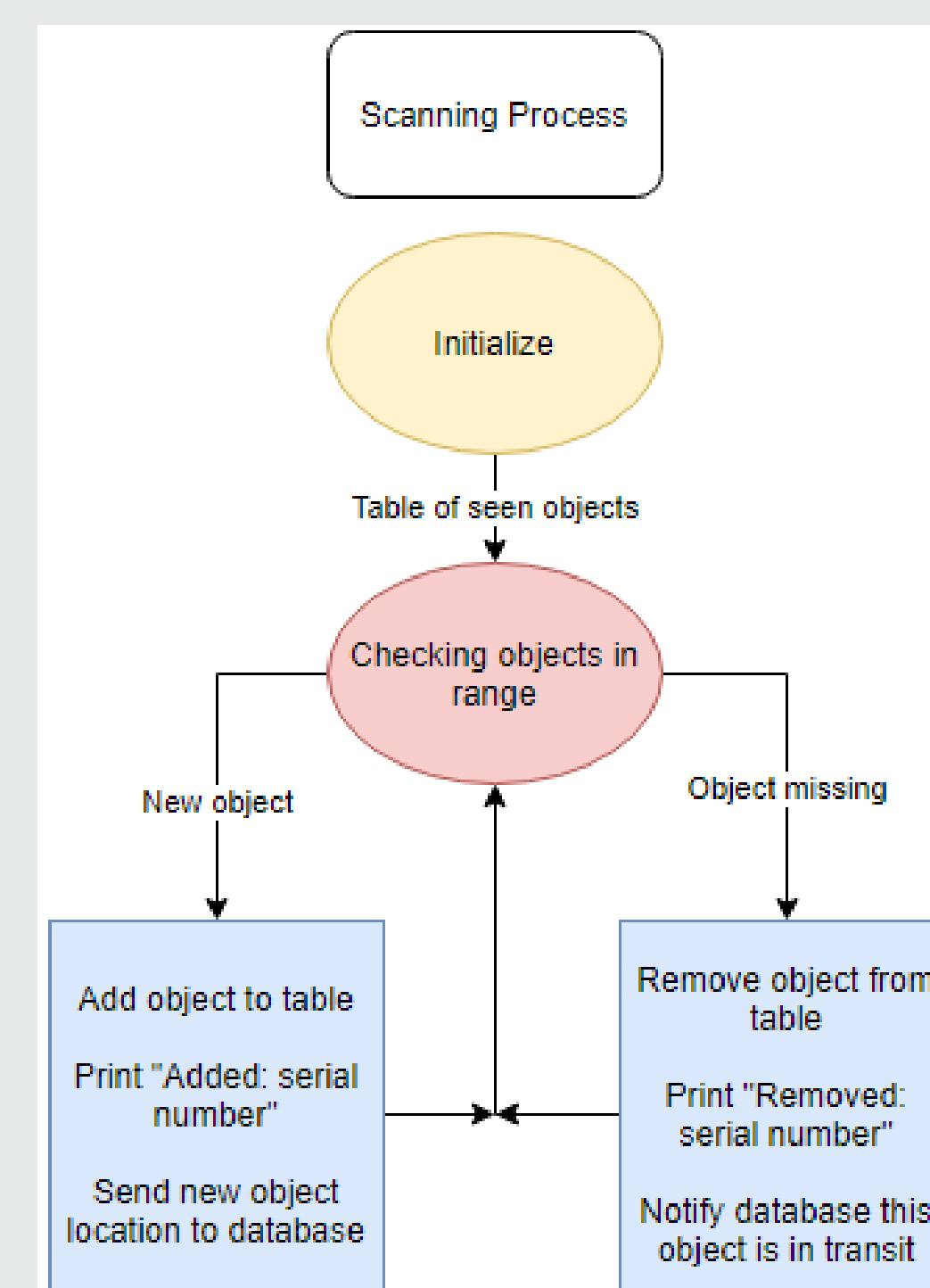
## System Architecture:

- System Architecture includes an RFID scanner, a microprocessor to interpret and transmit the scanning data, a database to store and track the information, and UI interfacing for users to interact with the system
- System overview shown below



## Scanning:

- The scanner periodically sends all objects in range to a microprocessor
- This list is then compared to an existing list of previously seen objects
- The list is updated accordingly, and updates are displayed on a screen and sent to the database, as shown in the figure below



## Database control:

- A primary table holding all cables and their current metadata (see Table #1 below)
- A secondary table containing the history of updates to the first table (see Table #2 below)
- Updates are made by the scanning process and by users at the company
- We plan to use Excel an VBA to implement this solution, but further development required

Part Name	Part #	Serial/Lot #	Client	Project	Location
Ex_Part 1	123	10001	C001	C001-01	Project Box
Ex_Part 2	456	10002	N/A	N/A	Controlled Goods

Table #1: Sample metadata table

Ex_part 1		
Date	User	Change
03/25/21	Scan_01	Location to "Project Box"
03/31/21	User_01	Location to "In Product"

Table #2: Sample update history table

## Future Work

- Complete component selection
- Acquire all set components to build a working model
- Develop the software that to integrate with the system and is easy to update
- The team plans to produce the first working prototype by the end of the summer
- Test and refine all parts of system design

## Testing Methodology

### Hardware:

- The team plans to test the range capabilities of the RFID tags to the RFID scanner over the summer
- Confirm reliable information transfer from RFID scanner to microprocessor to excel database
- Confirm the system can manage multiple simultaneous tags being added into the cabinet

### Software:

- The system can save history upon shutdown and restore information on restarting the system
- Ensure the microprocessor is correctly receiving the information from the RFID scanner
- Making sure the system can handle multiple users and can update accurately for all of those that are using the program

## Acknowledgements

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## References

- atlasRFIDstore. "What Is RFID? | The Beginner's Guide to RFID Systems." *AtlasRFIDstore*, 2020, [www.atlasrfidstore.com/rfid-beginners-guide/#:%7E:text=RFID%20tags%20transmit%20data%20about,to%20the%20antenna%2Freader%20combination.&text=The%20energy%20activates%20the%20chip,back%20toward%20the%20antenna%2Freader.](http://www.atlasrfidstore.com/rfid-beginners-guide/#:%7E:text=RFID%20tags%20transmit%20data%20about,to%20the%20antenna%2Freader%20combination.&text=The%20energy%20activates%20the%20chip,back%20toward%20the%20antenna%2Freader.)