Disc Finders
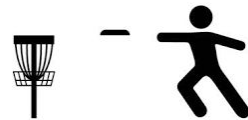
Corey Moura, Timothy Beler
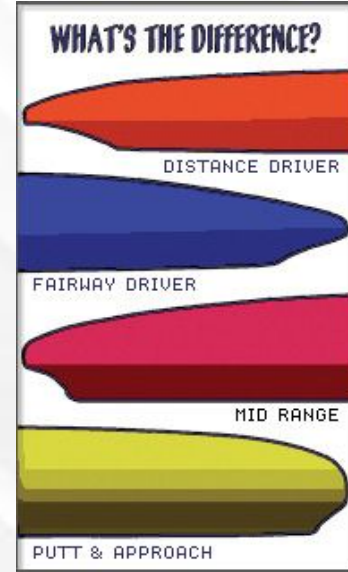
What is Disc Golf?

Disc golf is golf, except you throw your clubs.

Typical frisbee ($4 each)

Typical disc ($10-$18 each)
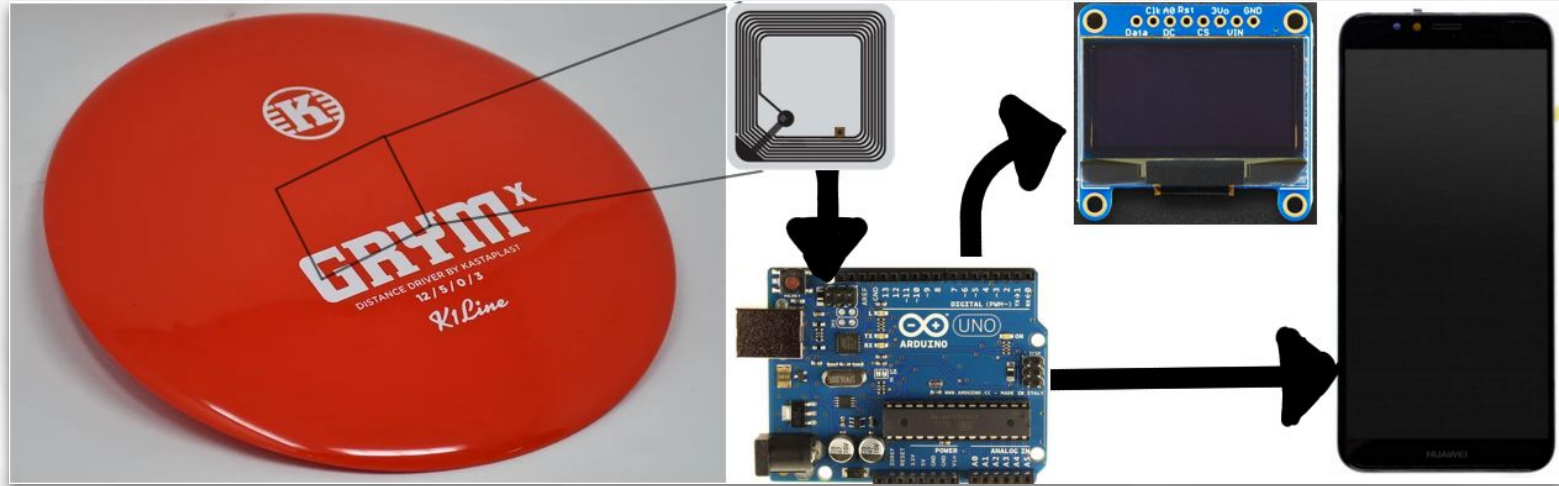
Losing a disc is common
Especially for beginners

Tee off area
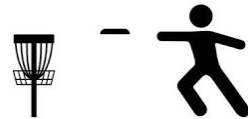
Project Description

We're using RFID technology to track lost discs. We are attempting to make it easy to use and accurate. First we're making a prototype using an Arduino. We hope to port the project onto a smartphone application.

Our goal with this product

Our goal is to have the device and tags available at shops that sell discs.

We hope we can provide cheap tags and a moderately priced device. The device would either communicate with a customers smartphone or have a quality display.

Even if the product doesn't have a long range it'll still save hours of the user's time.

This is our Gantt Chart

What's done

Feasibility Study and Research			
RFID / UHF / NFC tecnology	9/18/20	9/26/20	9
Available technology	9/18/20	9/26/20	9
Rasberry Pie and piggy-backs	9/18/20	9/26/20	9
Project Planning			
Requirements	9/25/20	9/30/20	6
Specifications	9/28/20	10/5/20	8
Design			
Generate Concepts	10/2/20	10/7/20	6
Select Top Concepts	10/6/20	10/8/20	3
Finalize Design	10/8/20	10/12/20	5
Hardware			
Order Required Hardware	10/12/20	10/17/20	6
Solder / Wire Hardware	10/18/20	10/20/20	3
Implementation			
Read an RFID Tag	9/18/20	9/21/20	4
Provide Console Feedback	9/21/20	9/23/20	3

Notes on those milestones:

❖ **Feasibility Study and Research**
  ➢ Deep dive - is this idea even possible?
  ➢ What hardware is available on the market (smartphones)?
  ➢ Is there support for implementation for developers?
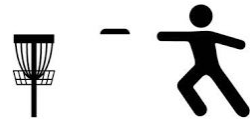
❖ **Project Planning**
  ➢ Determined the minimum requirement for our prototype
    ■ Read an RFID chip
    ■ Switch between different chips
    ■ Display the distance away from the tag if possible

❖ **Design**
  ➢ Brainstorm possible implementations
  ➢ Select design to move forward with

❖ **Implementation**
  ➢ Read an RFID Tag and show data in console

A glimpse of the research

Research and Documentation

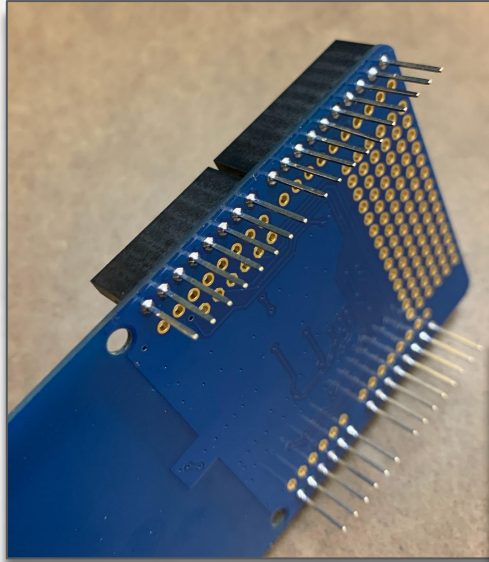| Technology	Description	Benefits	Drawbacks
NFC	Near Field Communication	N/A	N/A
Low Frequency RFID (LF RFID)	30kHz - 300Khz Rang: 0-10cm	N/A	N/A
High Frequency RFID (HF RFID)	3MHz - 30MHZ Range: 0.1-1m	N/A	N/A
Ultra High Frequency RFID (UHF RFID)	300MHz - 3GHz Range: 0-12m	Up to 12m (~39ft) of range.	
Passive RFID	Read only chip with no internal battery storage	Small, cheap, common	Limited by range and tag back-splatter ($14-$500 for readers)
Active RFID	Read and Write chip with internal battery	Increases range up to 100m	Size and cost
Semi-passive RFID (BAP RFID)	IInternal battery assists the send back reliability of the data	Limits passive tag back-splatter, on the cheaper side	New technology
Antenas	*Circular Polarization Transmits across a variety of planes (wider variety of tag orientations)*	*Linear Polarization Transmits in only 1 plane (longer range)*	

https://lowrysolutions.com/blog/what-are-the-different-types-of-rfid-technology/
https://www.google.com/shopping/product/3231119196082442729?q=passive+UHF+tag+reader&prds=epd:4821350654370195626,prmr:1&sa=X&ved=0ahUKEwiBo7gpl4jsAhVBR60KHSVOB1MQwzwICw
https://www.atlasrfidstore.com/turck-u-grok-it-uhf-rfid-reader-for-smartphones/
https://www.nephsystem.com/android-rfid-reader-suits-perfectly-for-smart-phones-a-58.html

Boards	Microcontroller	Operating Voltage/s (V)	Digital I/O Pins	PWM Enabled Pins	Analog I/O Pins	DC per I/O (mA)	Flash Memory (KB)	SRAM (KB)	EEPROM (KB)	Clock (MHz)	Length (mm)	Width (mm)	Cable	Native Network Support
Uno	ATmega328	5	14	6	6	20	32	2	1	16	68.6	53.4	USB A-B	None
Leonardo	ATmega32u4	5	20	7	12	40	32	2.5	1	16	68.6	53.3	micro-USB	None
Micro	ATmega32u4	5	20	7	12	40	32	2.5	1	16	48	18	micro-USB	None
Nano	ATmega328	5	22	6	8									
Mini	ATmega328	5	14		6									
Due	Atmel SAM3X8E ARM Cortex-M3 CPU	3.3	54	12										
Mega	ATmega2560	5	54	15										
M0	Atmel SAMD21	3.3	20	12										
Yun Mini	ATmega32u4	3.3	20	7	12									
Uno Ethernet	ATmega328p	5	20	4	6									
Tian	Atmel SAMD21	5	20	12										
Mega ADK	ATmega2560	5	54	15										
M0 Pro	Atmel SAMD21	3.3	20	12										
Industrial 101	ATmega32u4	5	7											
Uno Wifi	ATmega328	5	20											
			20											
			20											
			8	3										

Compatibility

MCU	Tested Works	Doesn't Work	Not Tested	Notes
Atmega328 @ 16MHz	X			SPI & I2C Works
Atmega328 @ 12MHz	X			SPI & I2C Works
Atmega32u4 @ 16MHz	X			Follow instructions at https://learn.adafruit.com/adafruit-pn532-rfid-nfc/shield-wiring#using-with-the-arduino-leonardo-and-yun to move pin 2.
Atmega32u4 @ 8MHz	X			SPI & I2C Works
ESP8266		X		SPI only, I2C clock stretching not supported
ESP32	X			SPI works; I2C works using IRQ and without sharing the I2C bus.
				SPI & I2C Works
				SPI & I2C Works
				SPI only, I2C clock stretching not supported. Use programming port.
			X	
			X	
			X	
			X	

ThingMagic RAIN Starter Kit

N390 iRF Pixie 860MHz~960MHz iOS Android Compatible RFID Dongle

Simultaneous RFID Tag Reader

What's done

Arduino Uno R3
+
Adafruit's
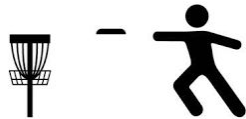PN532 RFID Shield

Searching for Tag...

    Embeded ID #: 15515630146
    Authenticating block 4 in EEPROM
    Blocks 4-7 have been authenticated
    Reading Block 4...

    Innova FireBird

Searching for Tag...

    Embeded ID #: 15515630146
    Authenticating block 4 in EEPROM
    Blocks 4-7 have been authenticated

Ooops ... unable to read the requested block. Try another key?

What needs to be done

Read an RFID Tag ID	10/21/20	10/25/20	5
Display Tag ID to Console	10/23/20	10/26/20	4
Write tag name to EEPROM	10/26/20	10/30/20	5
Read Tag Name From EEPROM	10/30/20	11/3/20	5
Display Data to OLED	11/3/20	11/10/20	8
GPIO Interrupt Via Ext. Switch	11/10/20	11/20/20	11
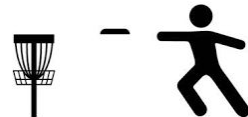
Use Case Description
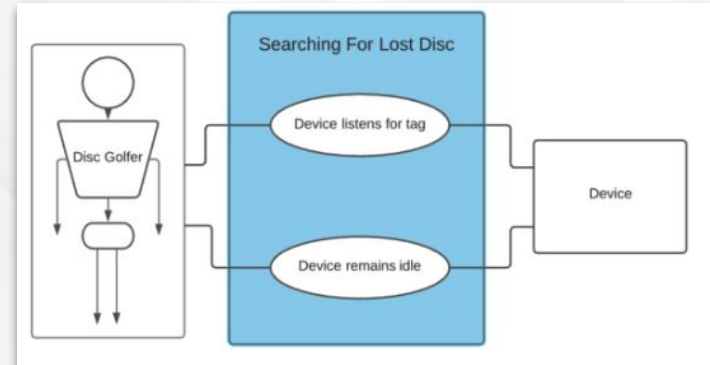
Associated Requirements

Extended Description

Use Case: **Device Listens for Tag**

Actors: Disc Golfer, Device

Description:
1. The disc golf player throws a disc to which they cannot find.
2. The device is used to transmit and receive the tags location.
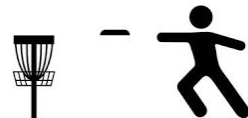3. On completion the disc golf player finds the lost disc.

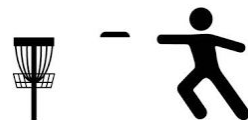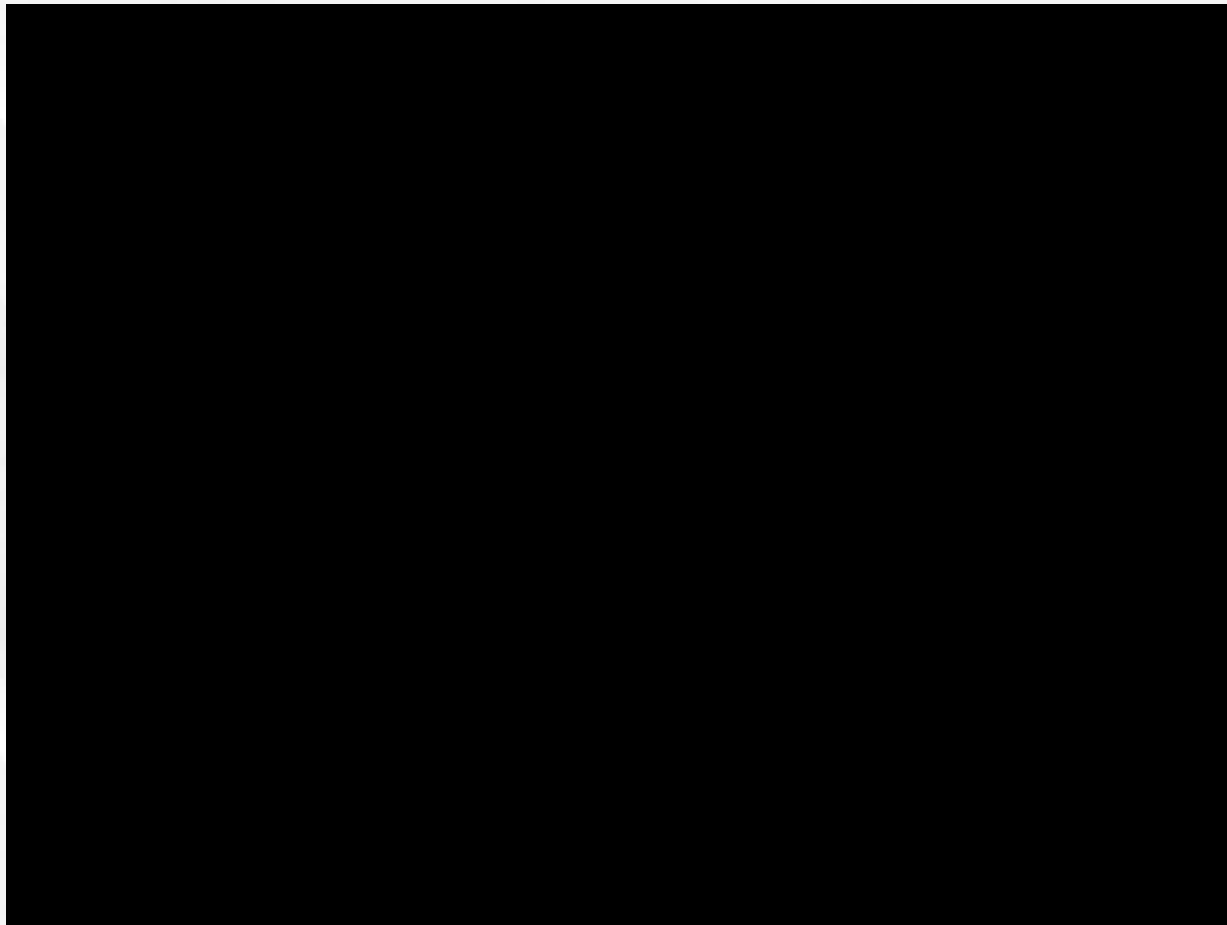**Cross Ref.:** Requirements 1.a., 2.a., 2.c.

1.a. Application shall detect RFID signal
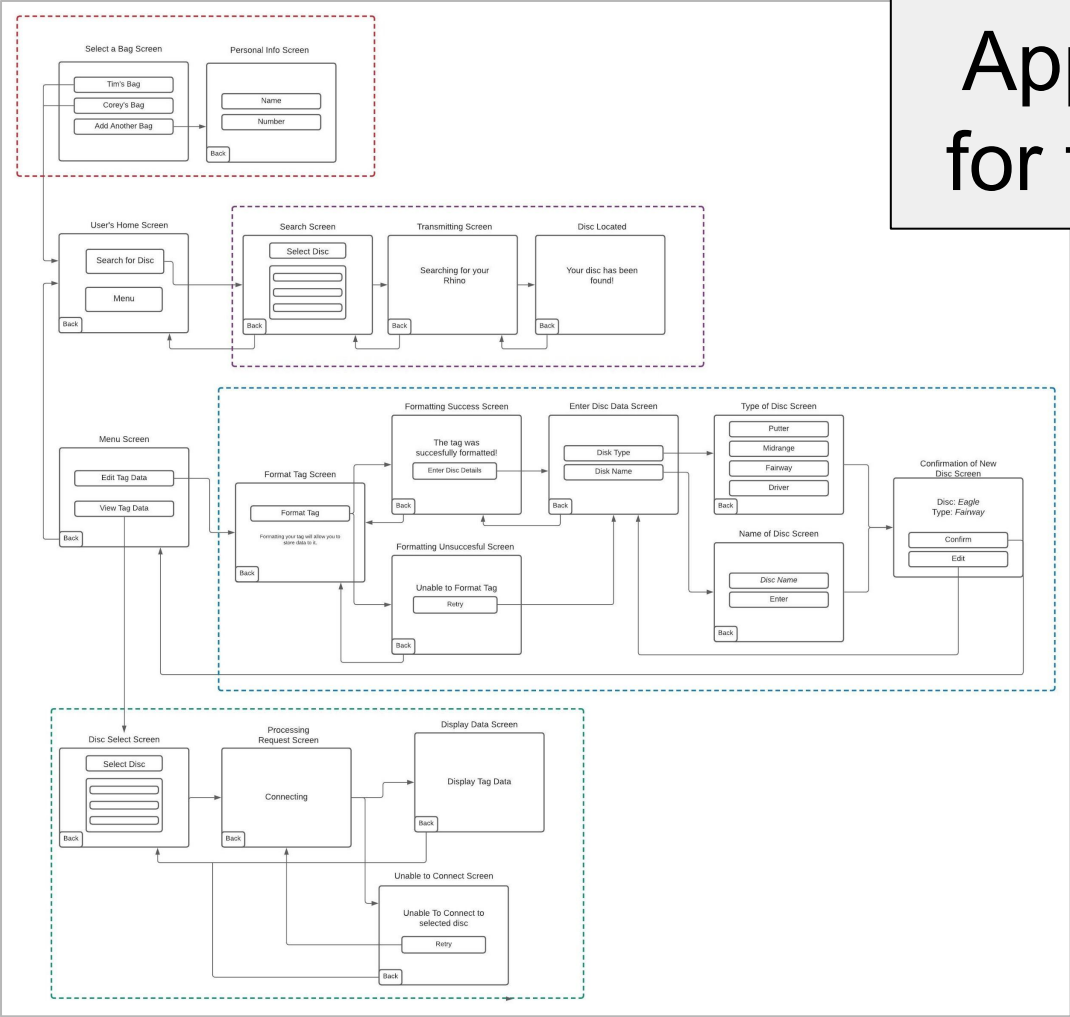
2.a. The display shall display RFID tag name

2.c. The display shall show how close the user is to the tag.

Project Demo

App screen flow chart for future development

THE END