

Architecture of Complex Systems

Week 1: *Systems Thinking*

Project Portfolio

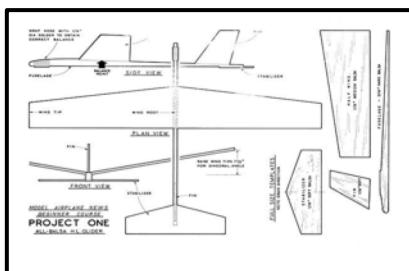
Name

John Doe

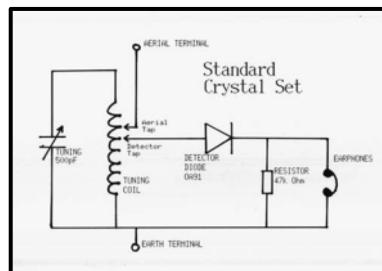
Step 1: SELECT YOUR SYSTEM

My system choice:

1-bit Adder



Balsa Wood Glider



Crystal Radio

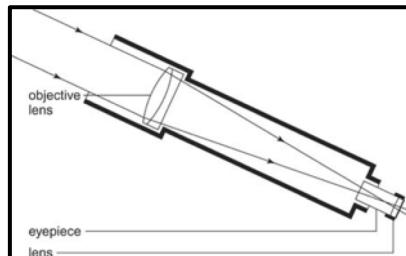
```
public void findPrimes(int n){
    int[] primes = new int[n];

    // Flag all numbers as prime initially
    for(int i = 0; i < n; i++)primes[i] = 1;

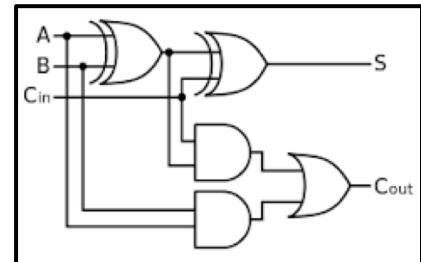
    // Compute all prime numbers
    for(int i = 2; i <= (int)(Math.sqrt(n)); i++){
        if (primes[i] == 1){
            for(int j = i; i*j < n; j++)primes[i*j] = 0;
        }
    }

    // Print out all prime numbers less than n
    for(int i = 1; i < n; i++){
        if(primes[i] == 1)System.out.printf("%d ", i);
    }
}
```

Prime Number Search Code



Simple Refracting Telescope



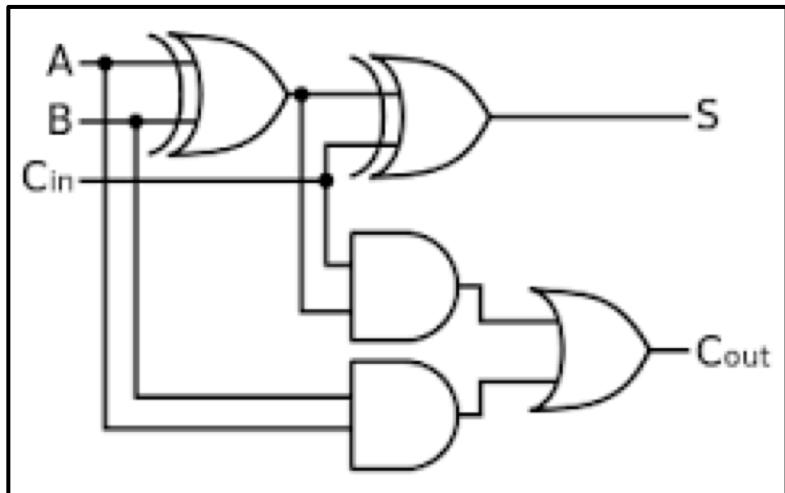
1-bit Adder

Step 2: IDENTIFY SYSTEM FORM & FUNCTION

Insert image you sourced representing your selected system in the box on the left side of the slide below. Then indicate the examples of **FORM** and **FUNCTION** that you've identified in the field on the right below.

Note: edX has a **10MB file size limit for document submission**. If you have selected large image(s), you may need to resize before submitting, OR you may simply include a web URL for the image in the image location.

System Diagram/Schematic



Primary System FORM:

Adder Circuit

Primary System FUNCTION:

Perform Arithmetic Calculation

Please describe why these elements of your system represent form and function and contextual interrelationship.

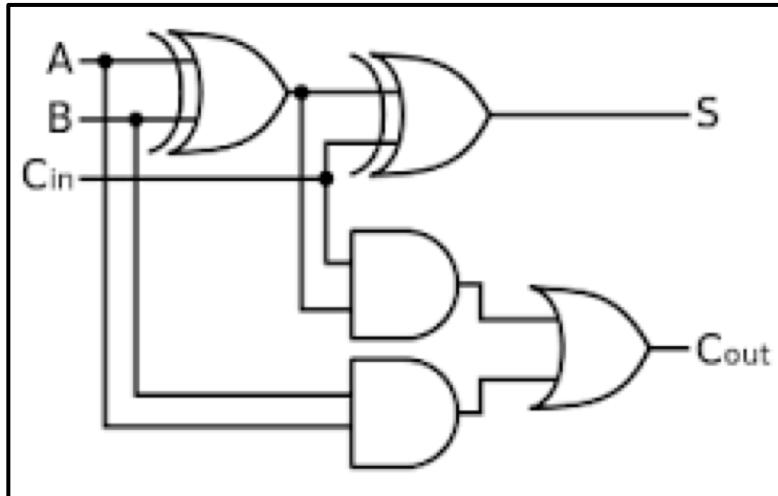
The adder circuit with its different types of gates and other components allows arithmetic operations which is the primary function of the system.

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System Diagram/Schematic



System Entity 1:

Exclusive disjunction

Form: XOR gate

Function: Setting Sum Bit

System Entity 2:

Logical conjunction

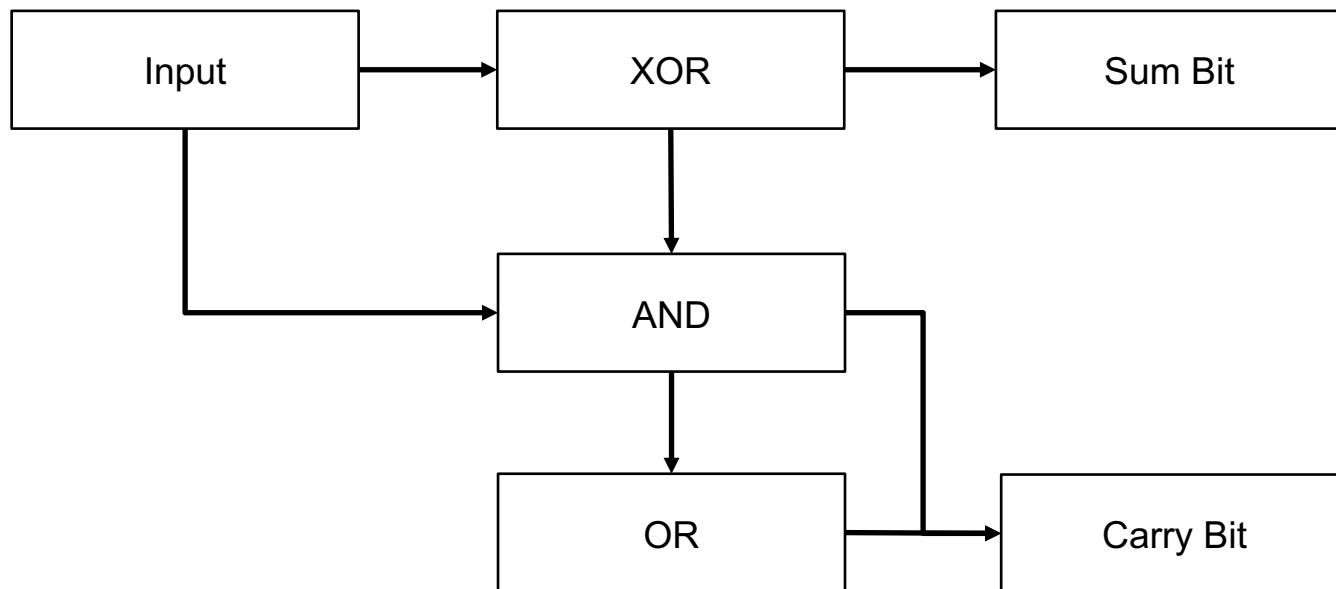
Form: AND Gate

Function: Setting Carry Bit

Step 4: IDENTIFY SYSTEM RELATIONSHIPS

Replace the names of Entities 1 and 2 in the diagram below with the first two entities you identified on the previous step. Identify at least 4 more entities in your system. Then, use the connectors to define the relationships between your entities. You may copy the objects you use more than once and delete any you don't use.

→ Connected to



Step 5: PREDICT SYSTEM EMERGENCE

For this step, you will predict two types of emergence in your system: intended and unintended, including emergence failures. Write a brief description of each emergent behavior of your system, and then explain how it occurred by describing its functional emergence.

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Intended Emergence

Accurate Arithmetic Operation

Functional Interaction

The components are attached properly as per the logic diagram.

(optional) Image



Insert image here.

Unintended Emergence

Incorrect arithmetic operation

Functional Interaction

The components are not attached properly as per the logic diagram for a 1-bit adder.
Internal components of the gate are not manufactured correctly.

(optional) Image



Insert image here.

Step 6: DEVELOP SYSTEM DECOMPOSITION

For your last step, develop a Level One system decomposition. Draw a decompositional view of your system that includes Level Zero and Level One.

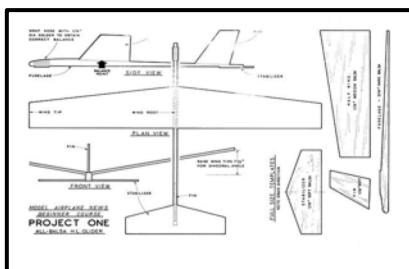
Level 0 :
Adder Circuit

Level 1:
XOR Gate
AND Gate
OR Gate
Sum Bit
Carry Bit
Input A
Input B
Input Carry

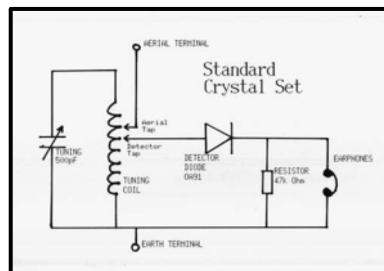
Step 1: SELECT YOUR SYSTEM

My system choice:

Balsa Wood Glider



Balsa Wood Glider



Crystal Radio

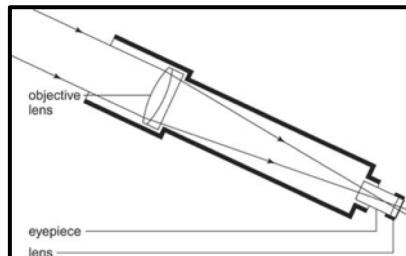
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    int[] primes = new int[n];

    // Flag all numbers as prime initially
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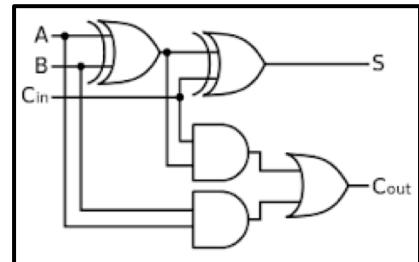
    // Compute all prime numbers
    for(int i = 2; i <= (int)(Math.sqrt(n)); i++){
        if (primes[i] == 1){
            for(int j = i; i*j < n; j++)primes[i*j] = 0;
        }
    }

    // Print out all prime numbers less than n
    for(int i = 1; i < n; i++){
        if(primes[i] == 1)System.out.printf("%d ", i);
    }
}
```

Prime Number Search Code



Simple Refracting Telescope



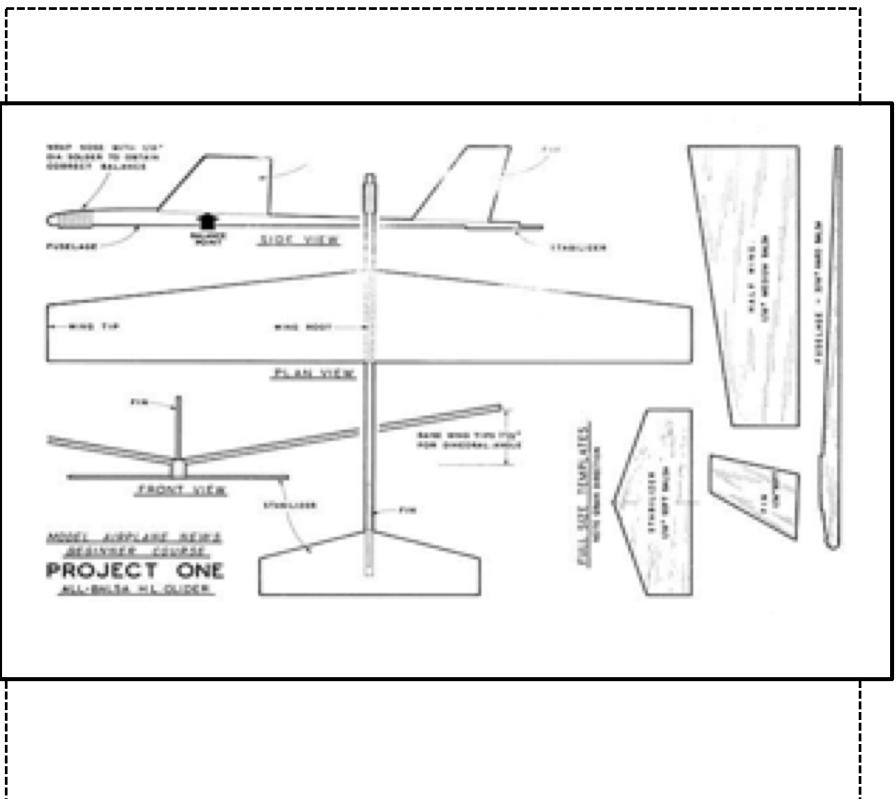
1-bit Adder

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System Diagram/Schematic



Primary System FORM:

Wooden Glider

Primary System FUNCTION:

Flying

Please describe why these elements of your system represent form and function and contextual interrelationship.

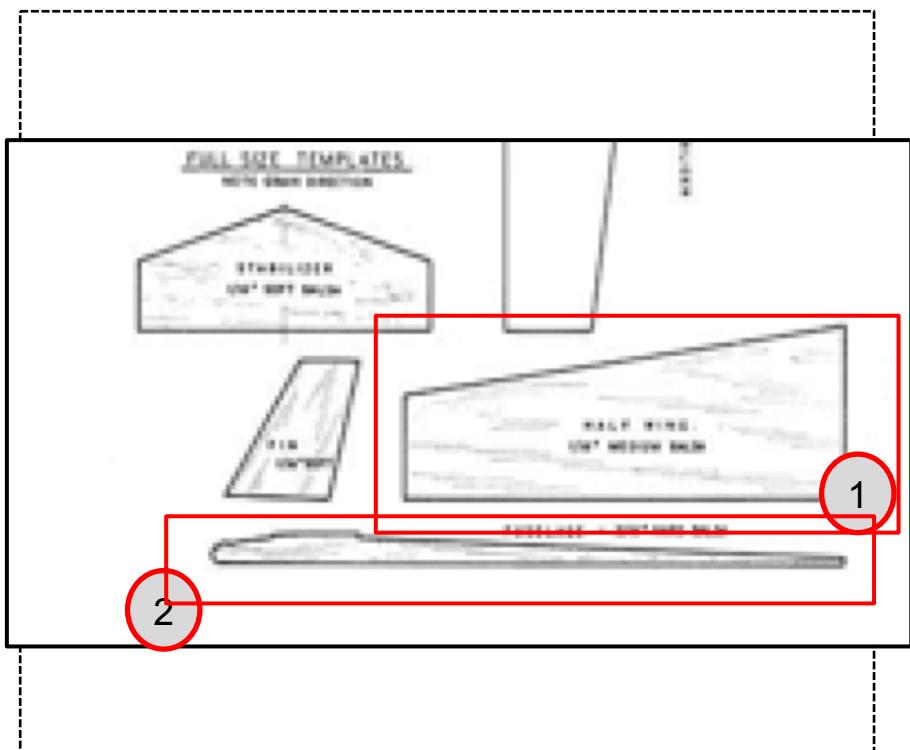
At a very basic level, someone wants the wooden glider to fly which gives them happiness or entertainment. Therefore the main purpose or the primary function is flying. The complete frame of the wooden gilder enables that function of flying so it's the primary form

Step 3: IDENTIFY SYSTEM ENTITIES

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System Diagram/Schematic



System Entity 1:

Main Wings

Form: Main Wing

Function: Provide Lift

System Entity 2:

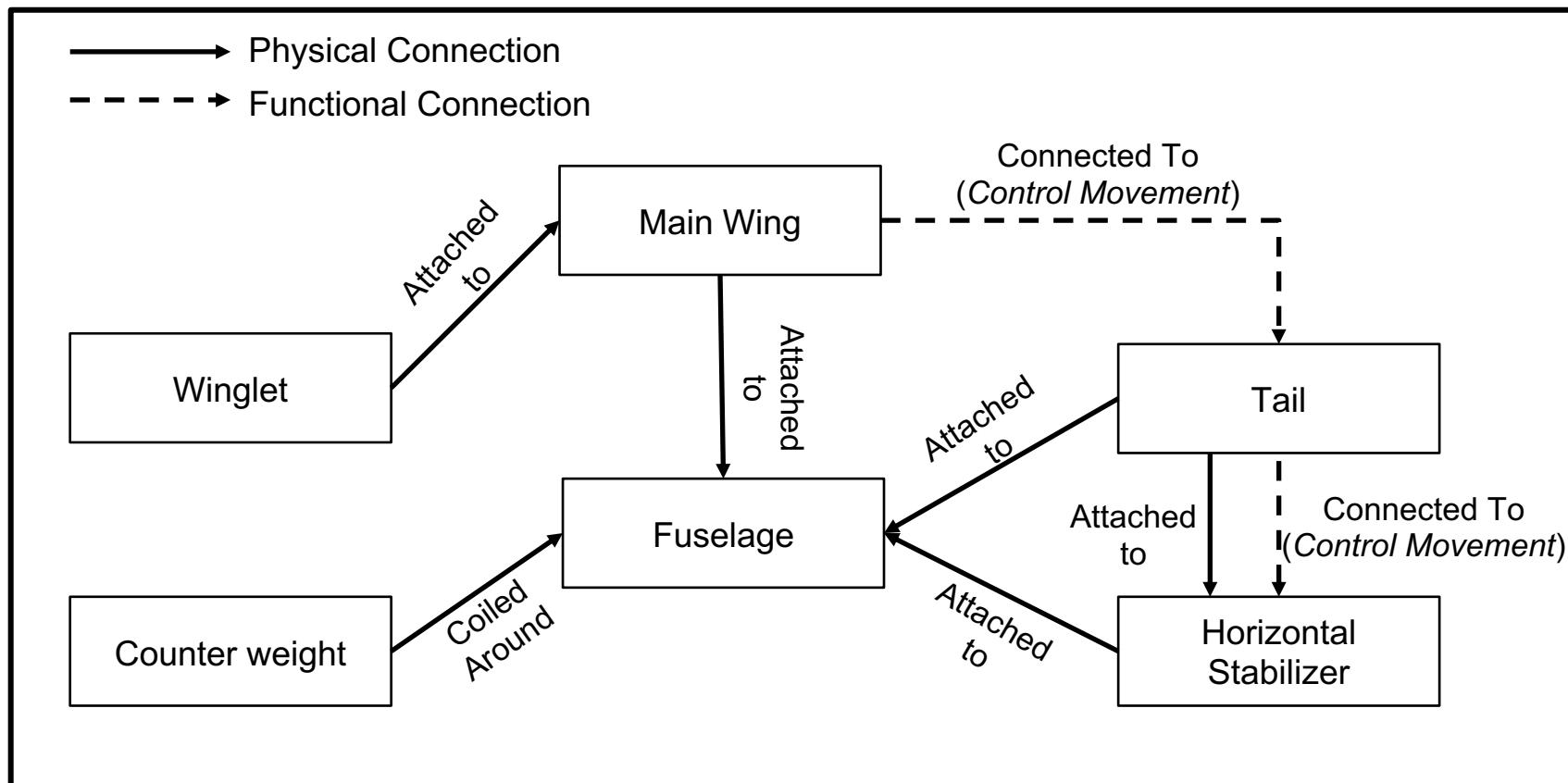
Fuselage

Form: Fuselage

Function: Supporting

Step 4: IDENTIFY SYSTEM RELATIONSHIPS

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Step 5: PREDICT SYSTEM EMERGENCE

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Intended Emergence

Gliding/Flying

Functional Interaction

All the system components are interacting with one another as expected to deliver the value function of flying. The operator is using the right technique to launch the glider in the air.

(optional) Image



Source: <http://www.shenghuozaizuo.net/woodworkingplan/?keyword=balsa-wood-glider-plane-plans>

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Unintended Emergence

Crashing/Breaking

Functional Interaction

Different entities mentioned in last slide are not attached properly (Physical connection). For example the main wing is not attached at a correct angle with respect to fuselage.

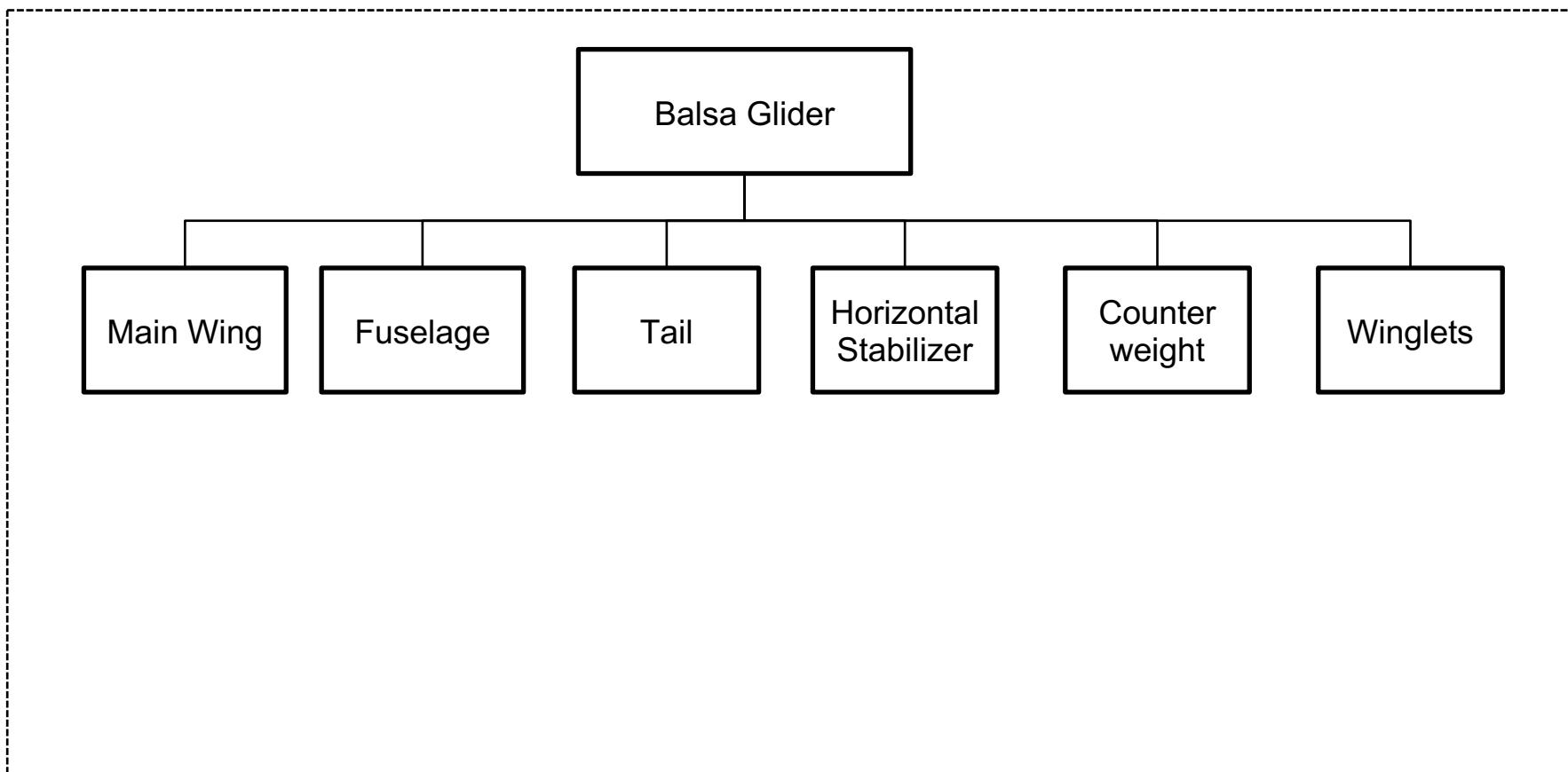
(optional) Image



Source <http://www.alamy.com/stock-photo/balsa-wood.html>

Step 6: DEVELOP SYSTEM DECOMPOSITION

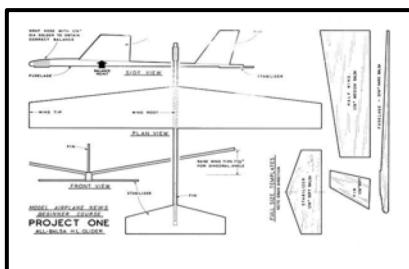
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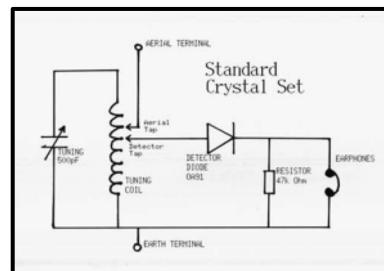
Step 1: SELECT YOUR SYSTEM

My system choice:

Crystal Radio



Balsa Wood Glider



Crystal Radio

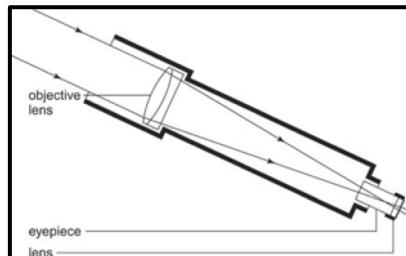
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public void findPrimes(int n){
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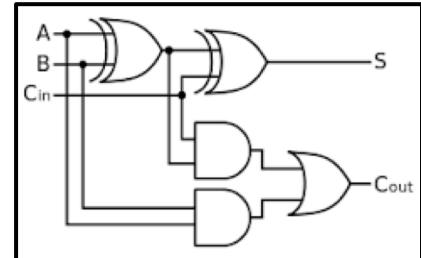
    // Compute all prime numbers
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            for(int j = i; i*j < n; j++)primes[i*j] = 0;
        }
    }

    // Print out all prime numbers less than n
    for(int i = 1; i < n; i++){
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    }
}
```

Prime Number Search Code



Simple Refracting Telescope



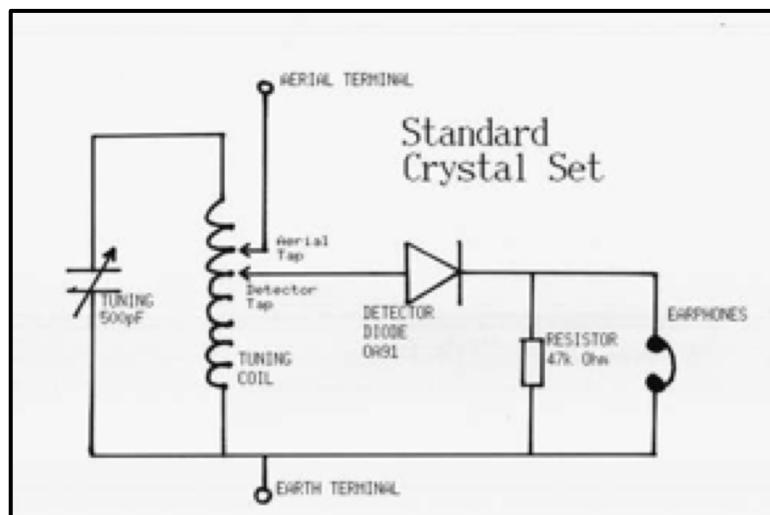
1-bit Adder

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System Diagram/Schematic



Primary System FORM:

Radio Receiver

Primary System FUNCTION:

Signal Processing

Please describe why these elements of your system represent form and function and contextual interrelationship.

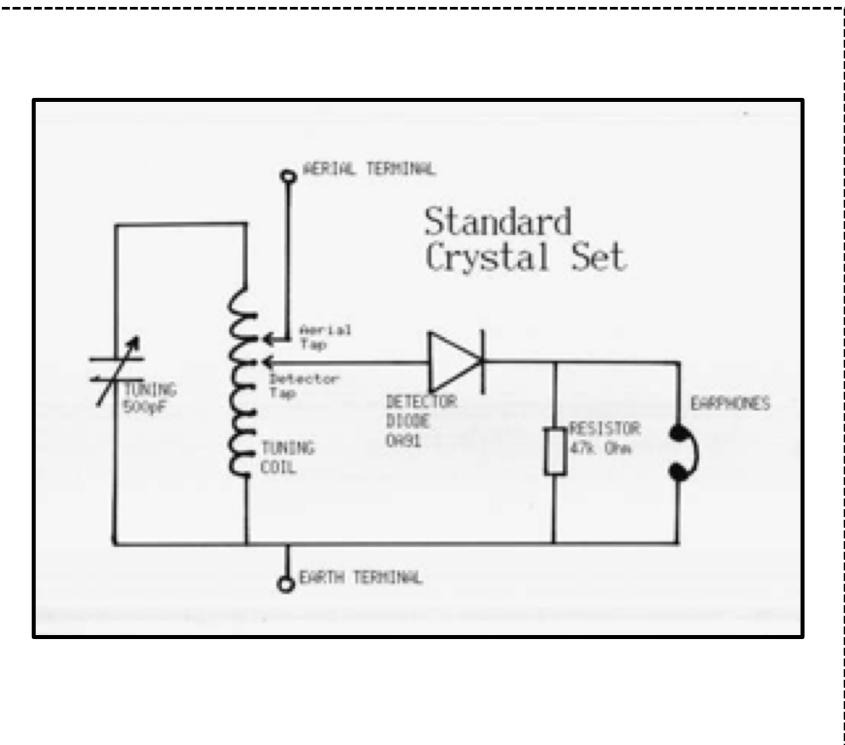
The crystal Radio has components that help receive and process radio waves, hence the Form name Radio Receiver and function signal processing.

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System Diagram/Schematic



System Entity 1:

Antenna

Form: Aerial Terminal

Function: Receive Radio Signal

System Entity 2:

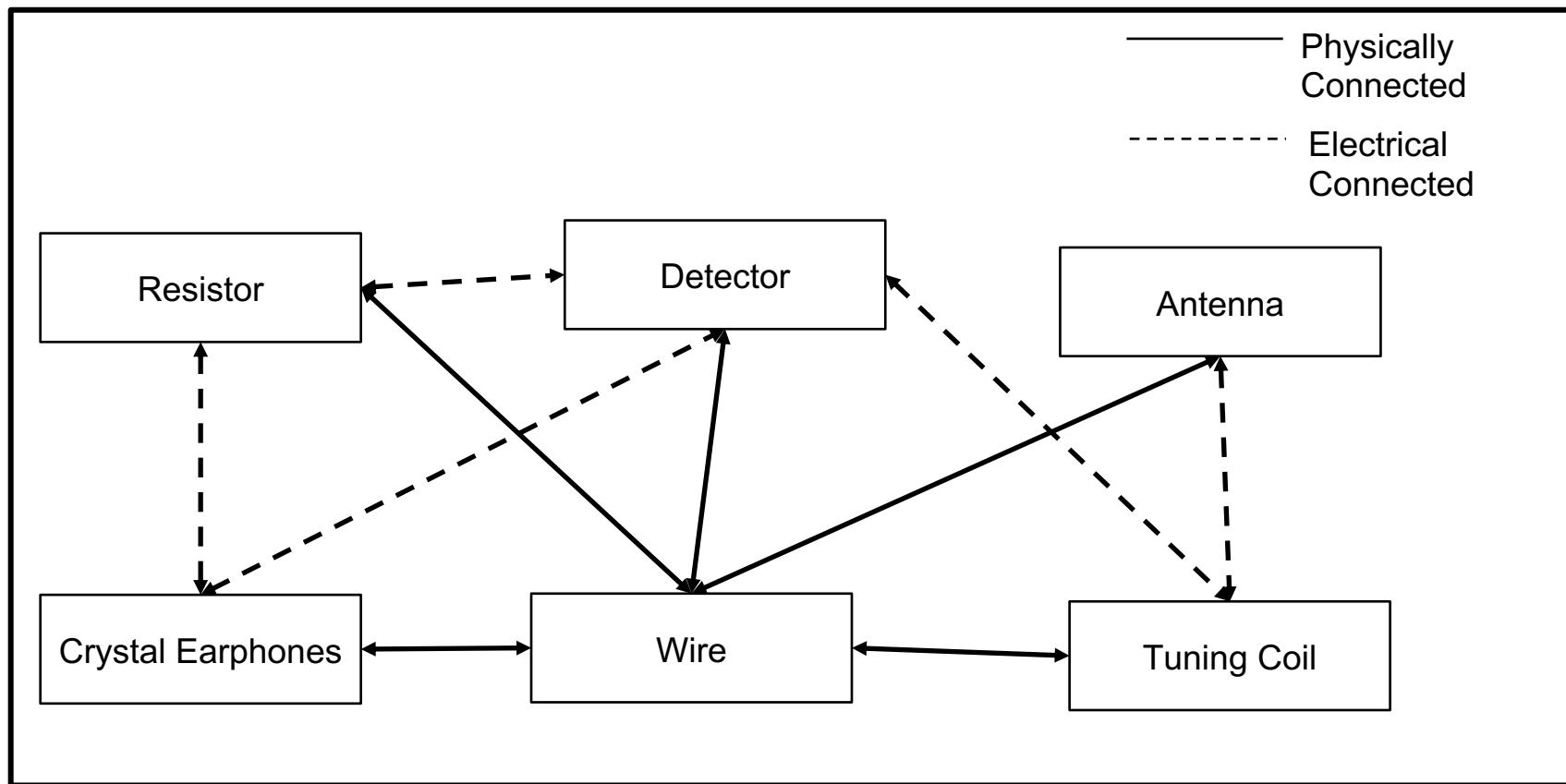
Detector

Form: Diode

Function: Demodulate radio signal, rectifying

Step 4: IDENTIFY SYSTEM RELATIONSHIPS

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Intended Emergence

Clear Audio in the earphones

Functional Interaction

The system is in proper working condition and there is a radio signal with sufficient strength and proper audio.

(optional) Image



Insert image here.

Unintended Emergence

Noise in earphones

Functional Interaction

The system is unable to catch the Radio signal.

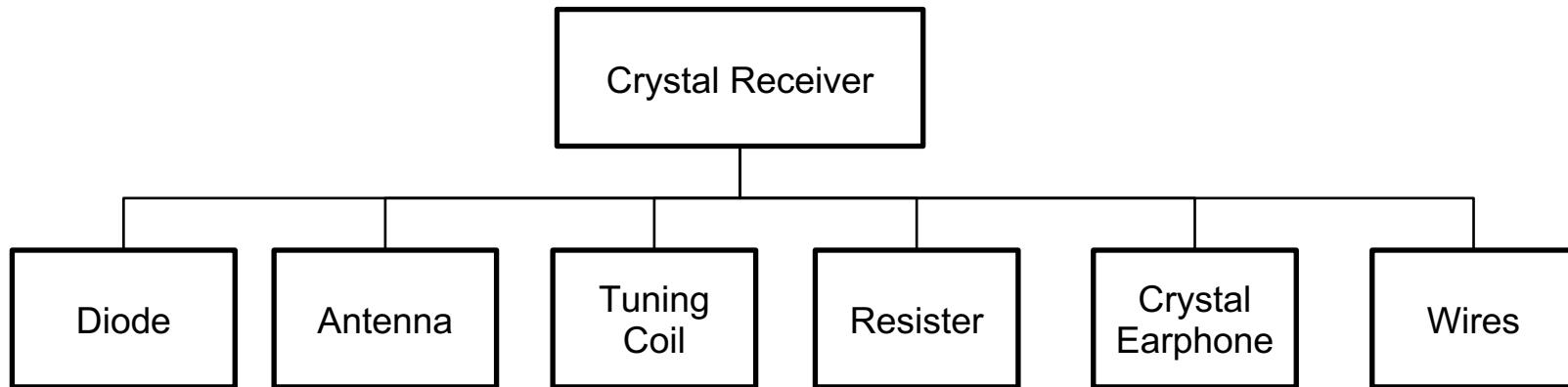
(optional) Image



Insert image here.

Step 6: DEVELOP SYSTEM DECOMPOSITION

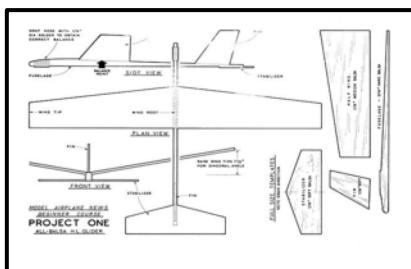
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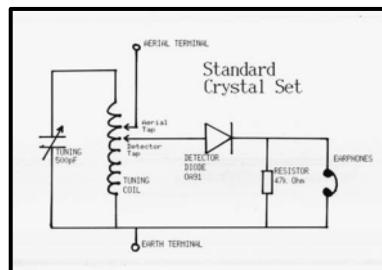
Step 1: SELECT YOUR SYSTEM

My system choice:

Prime No Search



Balsa Wood Glider



Crystal Radio

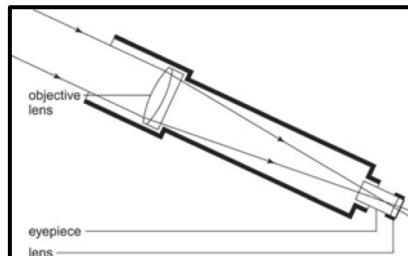
```
public void findPrimes(int n){
    int[] primes = new int[n];

    // Flag all numbers as prime initially
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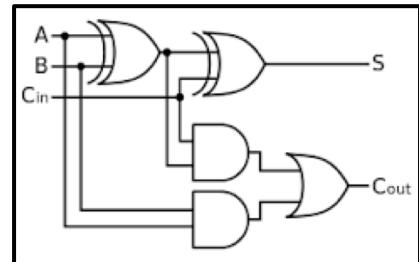
    // Compute all prime numbers
    for(int i = 2; i <= (int)(Math.sqrt(n)); i++){
        if (primes[i] == 1){
            for(int j = i; i*j < n; j++)primes[i*j] = 0;
        }
    }

    // Print out all prime numbers less than n
    for(int i = 1; i < n; i++){
        if(primes[i] == 1)System.out.printf("%d ", i);
    }
}
```

Prime Number Search Code



Simple Refracting Telescope



1-bit Adder

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System Diagram/Schematic



Insert image here.

Primary System FORM:

Prime No Search Algorithm

Primary System FUNCTION:

Identify Prime no

Please describe why these elements of your system represent form and function and contextual interrelationship.

The algorithm/code enables the identification of the Prime Numbers and prints them to console

Step 3: IDENTIFY SYSTEM ENTITIES

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System Diagram/Schematic



Copy the image you inserted into Slide 6 here.

System Entity 1:

Looping

Form: Loop Code

Function: Loop though list of prime no to check if input is divisible by any of those

System Entity 2:

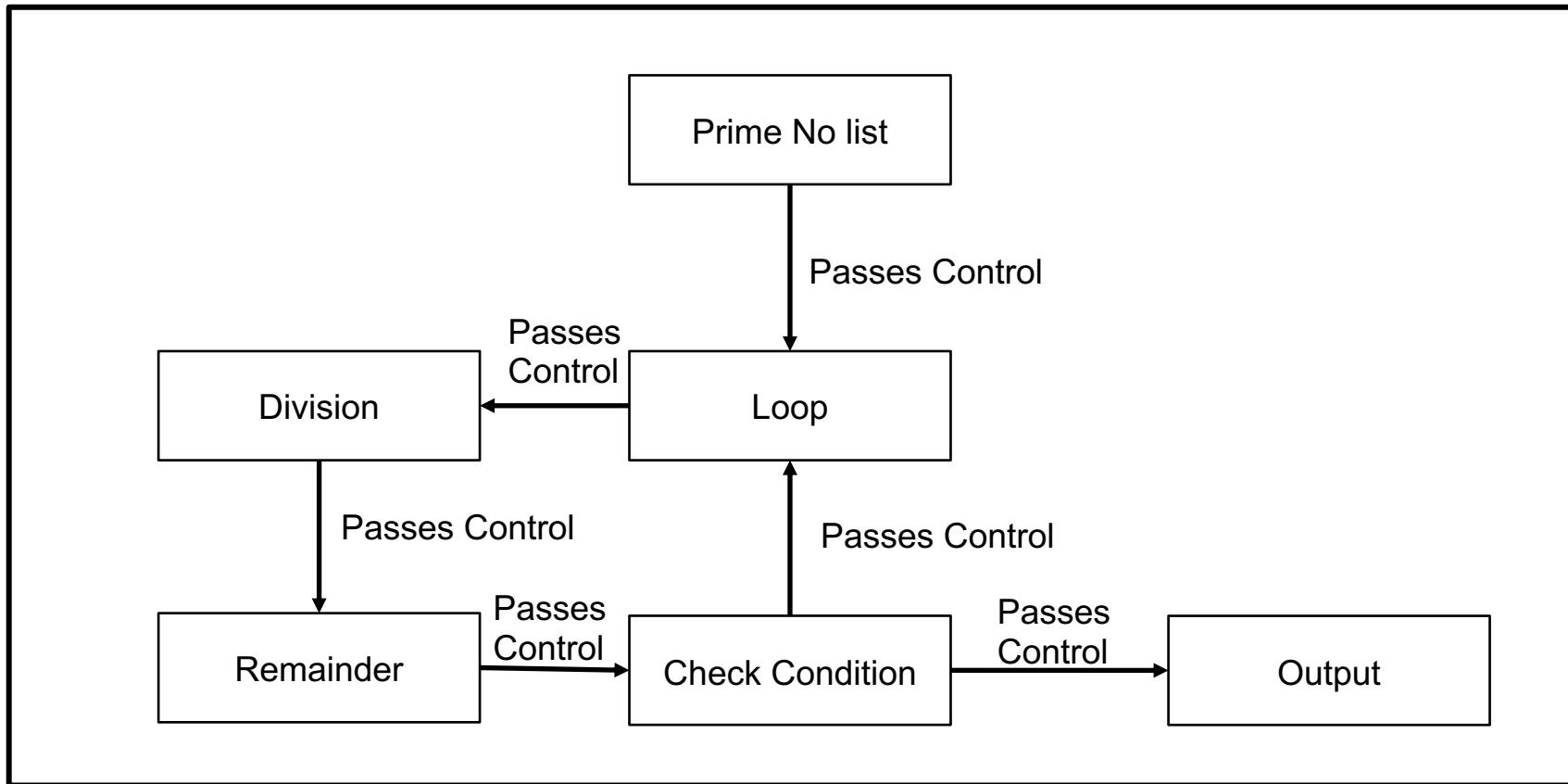
Division

Form: Division Code

Function: Divide the input with the given prime no

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Intended Emergence

Calculates with 100% accuracy if number is prime or not

Functional Interaction

The components are arranged in the right order and are coded properly. The code goes through a list of prime numbers less than input and tries to divide the input with these prime numbers. If no remainder exists then the number is prime. Prime numbers are printed to console.

(optional) Image



Insert image here.

Unintended Emergence

Program Crashes

Functional Interaction

User specifies a non numerical input that could not be properly handled by the program resulting in a crash or ValueError exception.

(optional) Image



Insert image here.

Step 6: DEVELOP SYSTEM DECOMPOSITION

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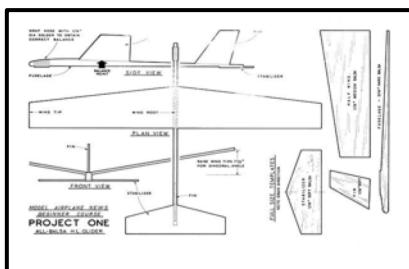
Level 0:
Prime No Search Algorithm

Level 1:
Input Retrieval
Prime No Array
Loop Condition
Division Operation
Remainder
Remainder Check Condition
Output

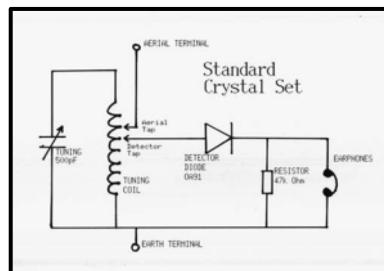
Step 1: SELECT YOUR SYSTEM

My system choice:

Refracting Telescope



Balsa Wood Glider



Crystal Radio

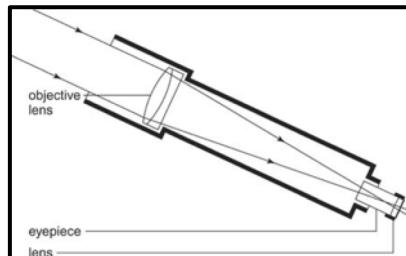
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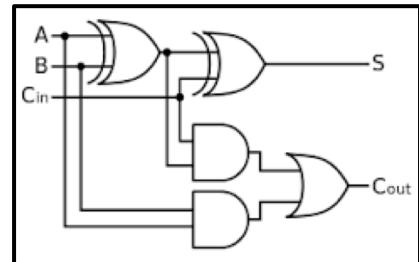
    // Compute all prime numbers
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}
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Prime Number Search Code



Simple Refracting Telescope



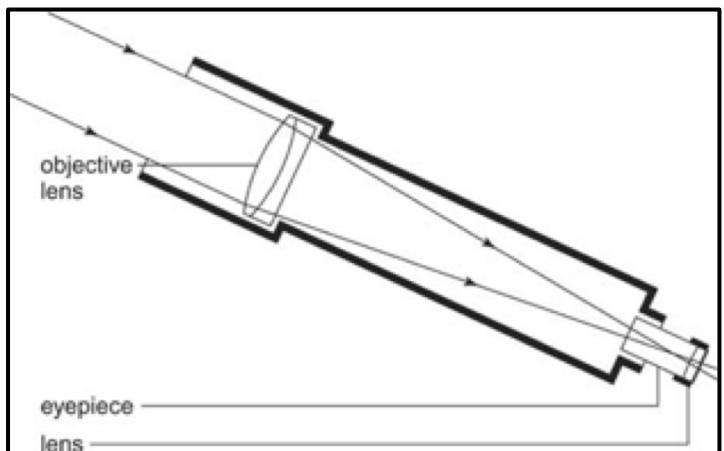
1-bit Adder

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System Diagram/Schematic



Primary System FORM:

Telescope Body

Primary System FUNCTION:

Image/Light Magnification

Please describe why these elements of your system represent form and function and contextual interrelationship.

The main purpose of the telescope is to magnify images so that they are more clearly visible.

Step 3: IDENTIFY SYSTEM ENTITIES

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System Diagram/Schematic



Copy the image you inserted into Slide 6 here.

System Entity 1:

Lens

Form: Objective Lens

Function: Refract the light so that it converges on focal plane

System Entity 2:

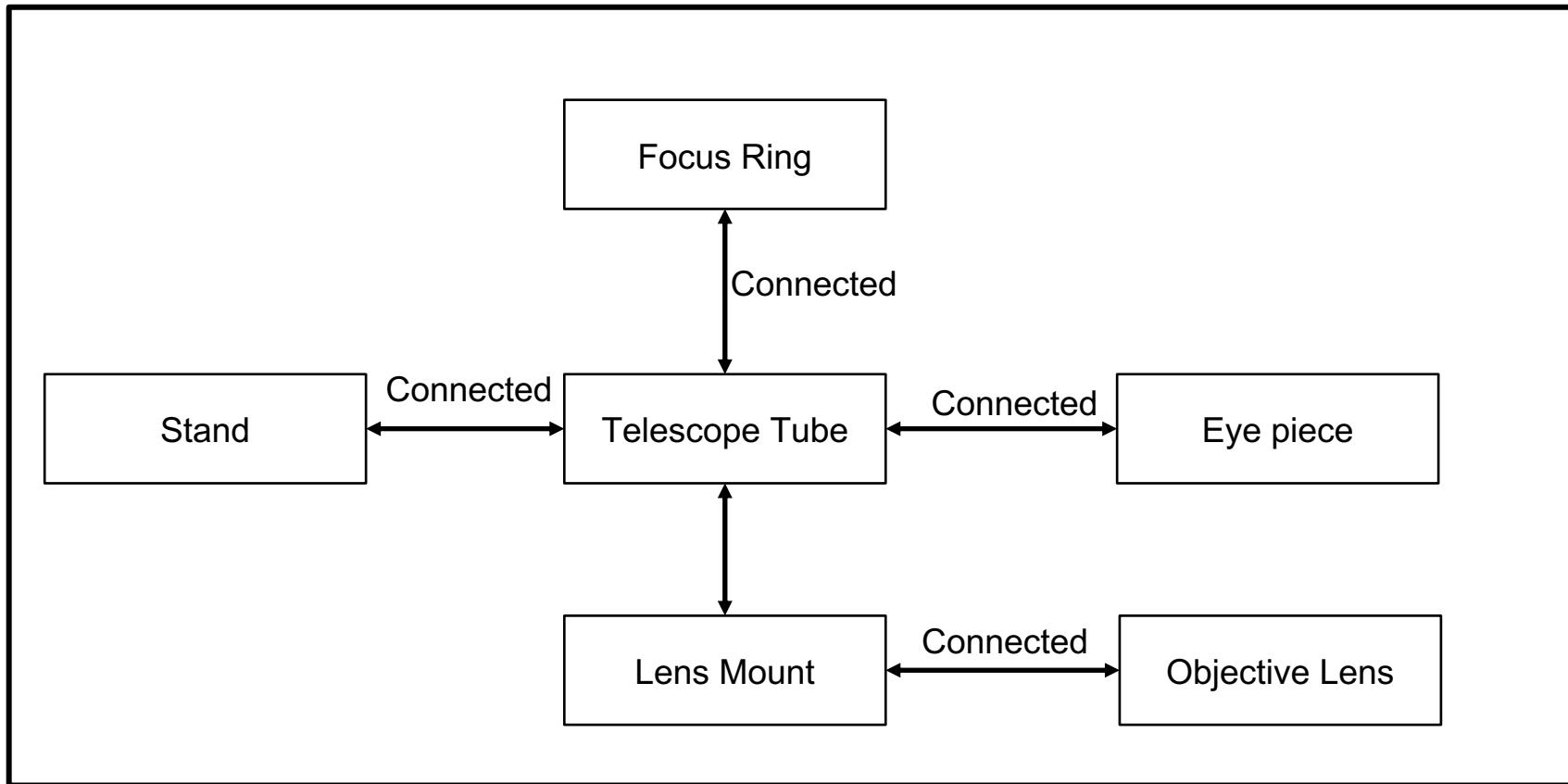
Eyepiece

Form: Eyepiece

Function: Show image that is formed on focal point

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Intended Emergence

Clear Magnified Image

Functional Interaction

The telescope assembly is working properly together. All the components are properly connected. The objective lens refracts the light on the focal point and the eyepiece shows that image to the viewer

(optional) Image



Insert image here.

Unintended Emergence

Unclear/Blurry Image

Functional Interaction

The focal point of the lens is off for the lens, the light is not converging at the right place causing a problem.

(optional) Image



Insert image here.

Step 6: DEVELOP SYSTEM DECOMPOSITION

For your last step, develop a Level One system decomposition. Draw a decompositional view of your system that includes Level Zero and Level One.

Level 0:

Telescope Assembly

Level 1:

Objective Lens

Eyepiece

Telescope Tube

Lens mount : To help attach the lens objective lens to the telescope tube

Stand (tripod) : Balance the telescope

Focus Ring