BIOVERSE #3
Pest Detector

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Team 15

INTRODUCTION

- Globalization
- Standards Considerations
- Feasibility Analysis
- Risk Analysis
- Plan of Action
- Multidisciplinary Aspects
- Personnel
- Budget
- End of Product Description

GLOBALIZATION

1. **Global Awareness**
2. **Successful Design**
3. **International Trade and WTO**
4. **Standards**
5. **Collaboration Tools**

STANDARDS CONSIDERATIONS

IEEE 1562-2007

IEEE 802.11

IEC 61508-Functional Safety

- Identifying the risk
- Identify the tolerability of each risk
- Identify the necessary risk reduction
- Explain each safety requirement for every risk reduction plan
- Design safety functions
- Authenticate the safety functions
- Apply the safety functions

FEASIBILITY ANALYSIS

- **Technical Feasibility**
- **Resource Feasibility**
- **Economic Feasibility**
- **Schedule Feasibility**
- **Cultural Feasibility**
- **Legal Feasibility**
- **Marketability Feasibility**

FEASIBILITY ANALYSIS

Attribute	Weight	Score	W. Score
Technical	0.38	3.75	1.43
Resource	0.26	4.5	1.17
Economic	0.13	4	0.52
Schedule	0.07	3	0.21
Cultural	0.07	5	0.35
Legal	0.05	3.5	0.18
Marketability	0.06	3.5	0.21
Total	1.00	27.25	4.07
Weighted Average			4.07

RISK ANALYSIS

1) Technical

T1. Low Bluetooth connectivity

T2. Slow processing speed

T3. High power consumption

2) Resources

R1. Electronic Skills

R2. Programming Skills

R3. Acquire the appropriate components

3) Economic

E1. Using unnecessary components

4) Schedule

S1. Balancing school and works schedule

S2. Time to learn new skills

S3. Procrastination

5) Cultural

C1. Low social support for the product

6) Legal

L1. Sponsors and team contract

7) Marketing

M1. Achieve the design specifications to make the product marketable

M2. Product not being completive on the market.

PLAN OF ACTION

- Battery unit

Start: 09/20/2019 End: 2/31/2020

- Coding

Start: 09/05/2019 End: 04/15/2020

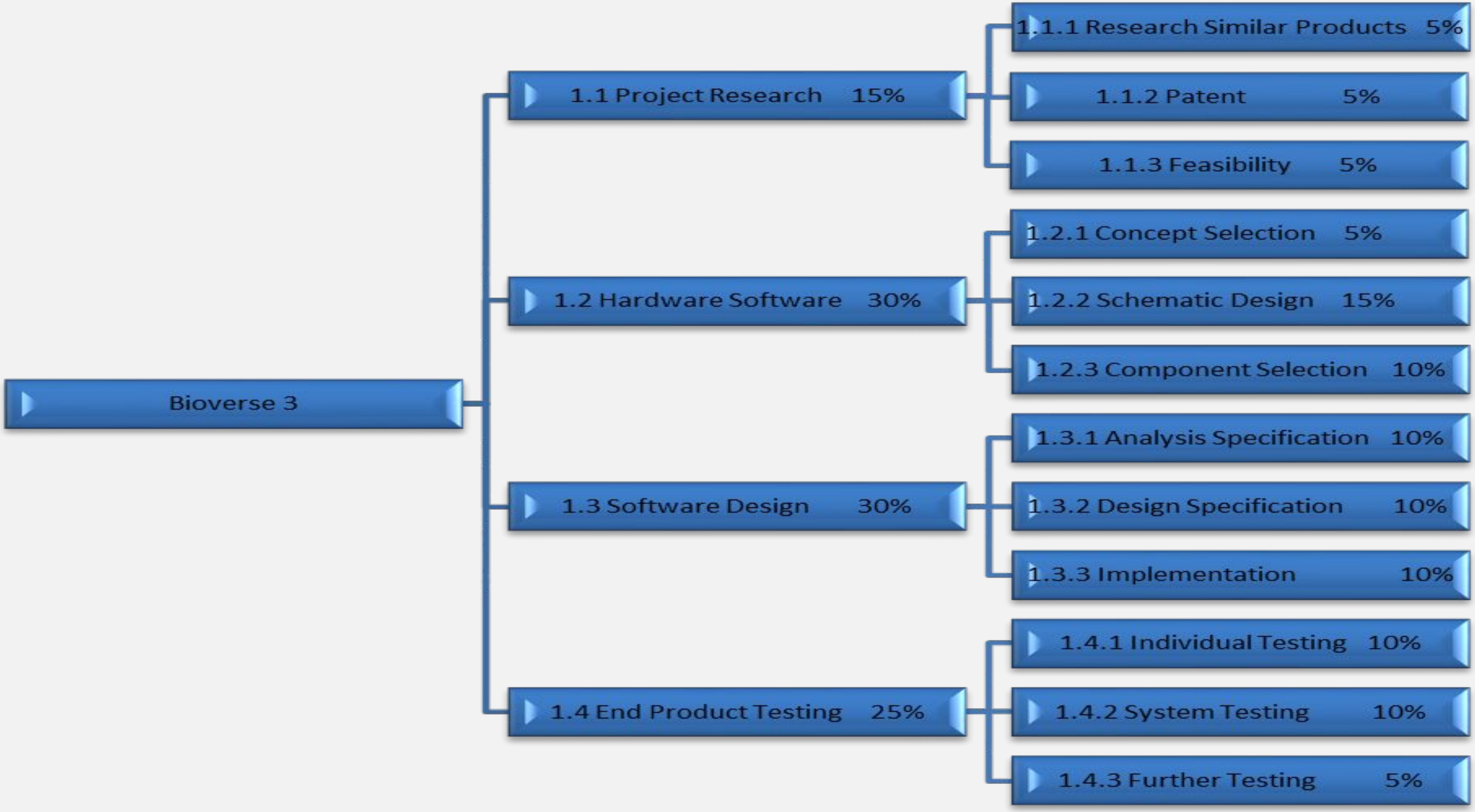
- Ideal Microcontroller

Start: 09/20/2019 End: 12/10/2019

- Case Design

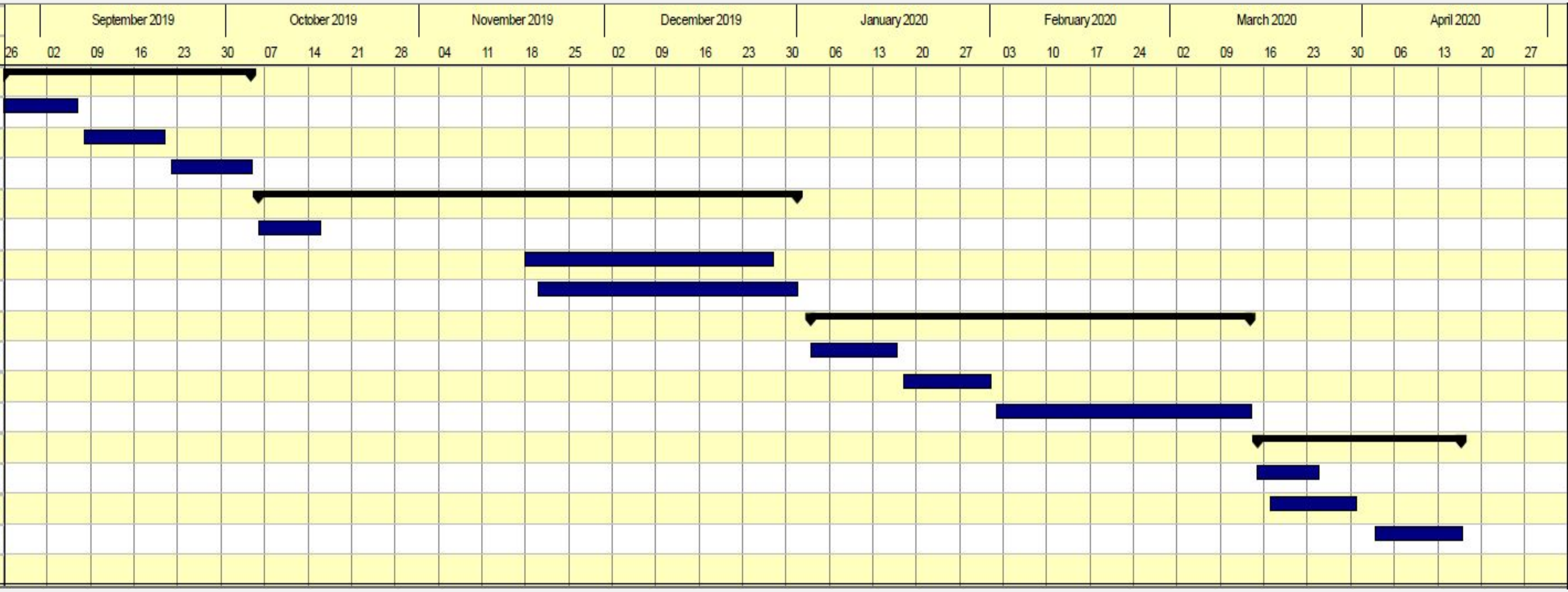
Start: 09/16/2019 End: 02/20/2020

Work Breakdown Structure

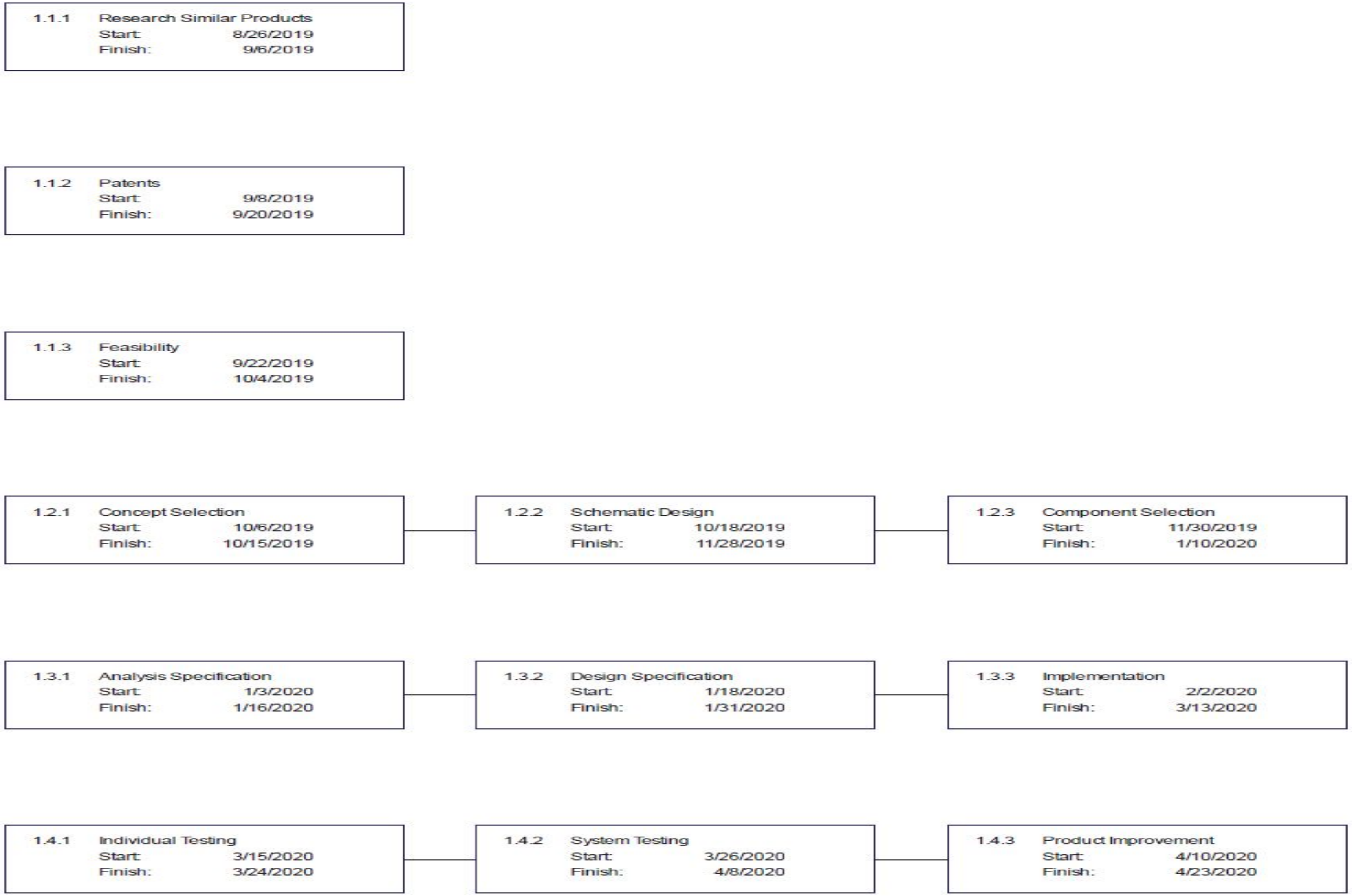


GANTT Chart

ID	Name	Start	Finish
1.1	**Project Research**	**8/26/2019**	**10/4/2019**
1.1.1	Research Similar Products	8/26/2019	9/6/2019
1.1.2	Patents	9/8/2019	9/20/2019
1.1.3	Feasibility	9/22/2019	10/4/2019
1.2	**Hardware Design**	**10/6/2019**	**12/31/2019**
1.2.1	Concept Selection	10/6/2019	10/15/2019
1.2.2	Schematic Design	11/18/2019	12/27/2019
1.2.3	Component Selection	11/20/2019	12/31/2019
1.3	**Software Design**	**1/3/2020**	**3/13/2020**
1.3.1	Analysis Specification	1/3/2020	1/16/2020
1.3.2	Design Specification	1/18/2020	1/31/2020
1.3.3	Implementation	2/2/2020	3/13/2020
	End Product Testing	**3/15/2020**	**4/16/2020**
1.4.1	Individual Testing	3/15/2020	3/24/2020
1.4.2	System Testing	3/17/2020	3/30/2020
1.4.3	Product Improvement	4/3/2020	4/16/2020



Pert Chart



1.1.1 Research Similar Products
Start: 8/26/2019
Finish: 9/6/2019
1.1.2 Patents
Start: 9/8/2019
Finish: 9/20/2019
1.1.3 Feasibility
Start: 9/22/2019
Finish: 10/4/2019
1.2.1 Concept Selection
Start: 10/6/2019
Finish: 10/15/2019
1.2.2 Schematic Design
Start: 10/18/2019
Finish: 11/28/2019
1.2.3 Component Selection
Start: 11/30/2019
Finish: 1/10/2020
1.3.1 Analysis Specification
Start: 1/3/2020
Finish: 1/16/2020
1.3.2 Design Specification
Start: 1/18/2020
Finish: 1/31/2020
1.3.3 Implementation
Start: 2/2/2020
Finish: 3/13/2020
1.4.1 Individual Testing
Start: 3/15/2020
Finish: 3/24/2020
1.4.2 System Testing
Start: 3/26/2020
Finish: 4/8/2020
1.4.3 Product Improvement
Start: 4/10/2020
Finish: 4/23/2020

MULTIDISCIPLINARY ASPECTS

1. Denis Solano(Electrical Engineer) – Denis is an all around electrical engineer that has a focus on designing and developing circuitry. He has completed past projects like analysis and protection of high voltage transmission systems.

2. Jorge L. Alfonso (Computer Engineer) – Jorge is one of the lead programmers for the teams design. He has taken various classes on java classes, of which include certifications outside of Florida International University.

3. Eder Matta(Electrical Engineering) – Eder has helped on several biomedical engineering projects by making sure that their circuitry was correct and helping them in any way he can. He has worked on projects such as heart rate sensors muscle flexion and small scale incubator.

4. Perry Gabriel (Electrical Engineer) - Perry brings a well rounded approach to this project, by having past experience in both hardware and software. He spends free time learning how to develop deep learning frameworks such as TensorFlow and Keras.

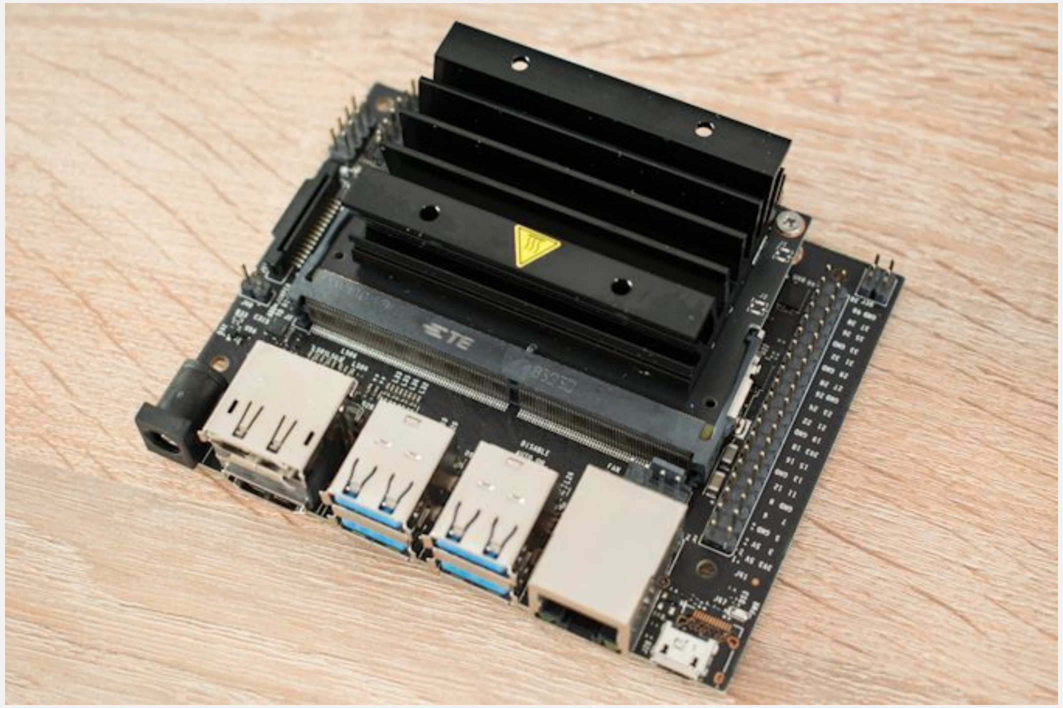
5.Damian Ferrer (Computer Engineering) – Damian has deep focus in focus in programming and more specifically, automation engineering. He has done a variety of programming projects including creating algorithms for financial markets such as the stock and bonds market.

BUDGET

			Hours	Cost
1.1	**Research Phase**			
1.1.1	Researching similar products			
1.1.2	Researching components			
1.1.3	Final Senior Paper	Damian Ferrer	10	$ 100.00
		Eder Matta	10	$ 100.00
		Perry Gabriel	10	$ 100.00
		Denis Solano	10	$ 100.00
		Jorge Alfonso	10	$ 100.00
1.2	**Hardware Design**			
1.2.1	Designing on the component	Eder Matta	10	$ 100.00
1.2.2.	Placement of components	Denis Solano	10	$ 100.00
1.2.3	Product assembly	Denis Solano	25	$ 250.00
		Eder Matta		
1.3	**Software Design**			
1.3.1	Preparing pseudocode	Perry Gabriel	15	$ 150.00
1.3.2	Calibraitng sensors	Damian Ferrer	10	$ 100.00
1.3.3	Programming CPU and sensors	Jorge Alfonso	15	$ 150.00
1.3.4	Finalizing code to be functional	Damian Ferrer	15	$ 150.00
		Perry Gabriel	15	$ 150.00
		Jorge Alfonso	15	$ 150.00
1.4	**Protype testing**			
1.4.1	Testing functionality in field	Damian Ferrer	20	$ 200.00
		Denis Solano	20	$ 200.00
1.4.2	Adjusting for any bugs encountere	Eder Matta	20	$ 200.00
		Jorge Alfonso	20	$ 200.00
1.4.3	Finalizing complete design with cas	Perry Gabriel	25	$ 250.00
			Total	Estimate
			285	$2,850.00

END PRODUCT DESCRIPTION

- End Product Description
  - Bioverse 3 - A.I. IoT Edge Detection System
  - iNaturalist Dataset
  - Custom Box for NV Jetson Nano, G Coral Dev Bd, RPi0, RPi4B
  - Google Cloud Platform
- Functions
- Specifications
- Other Deliverables



END PRODUCT DESCRIPTION

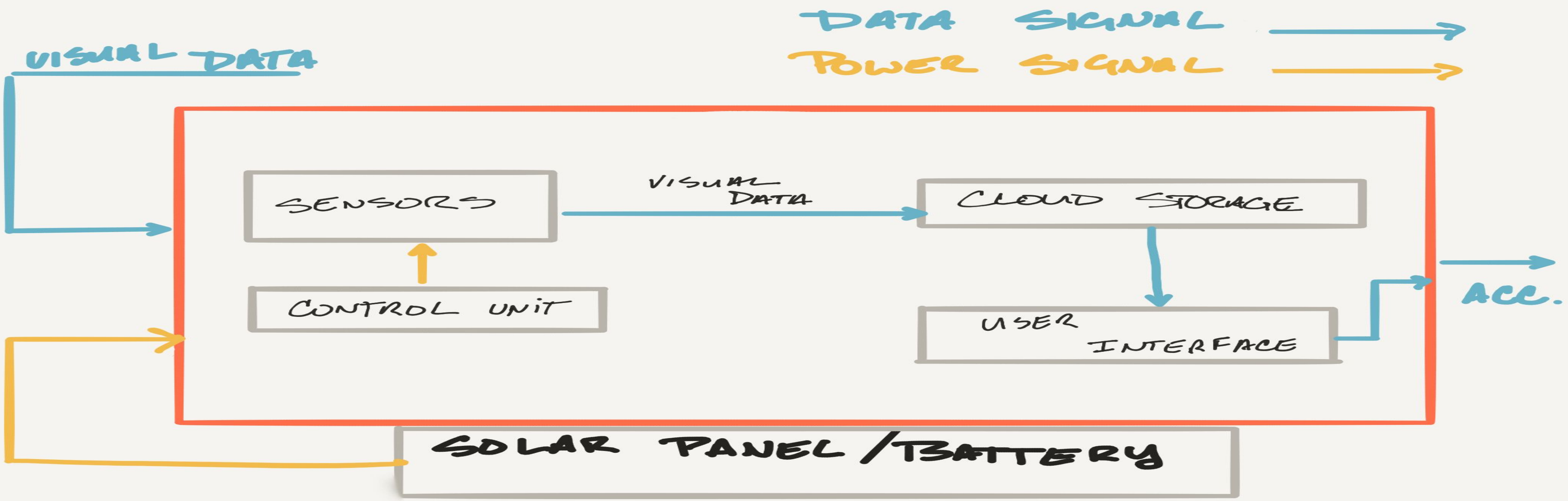
Level 0 Block Diagram

END PRODUCT DESCRIPTION

Module	Bioverse 3 IoT Invasive Species Detection Process
Inputs	Ecosystem Condition Readings(Visual Images) Power Signal from DC Source/ User configured network connection
Outputs	Recordings from ecosystem through Raspberry Pi Camera Module, Accuracy Measurement Readings
Functionality	Detect Invasive species by sending information to Google Cloud IoT Core for detection and training.

Level 0 Functionality

END PRODUCT DESCRIPTION

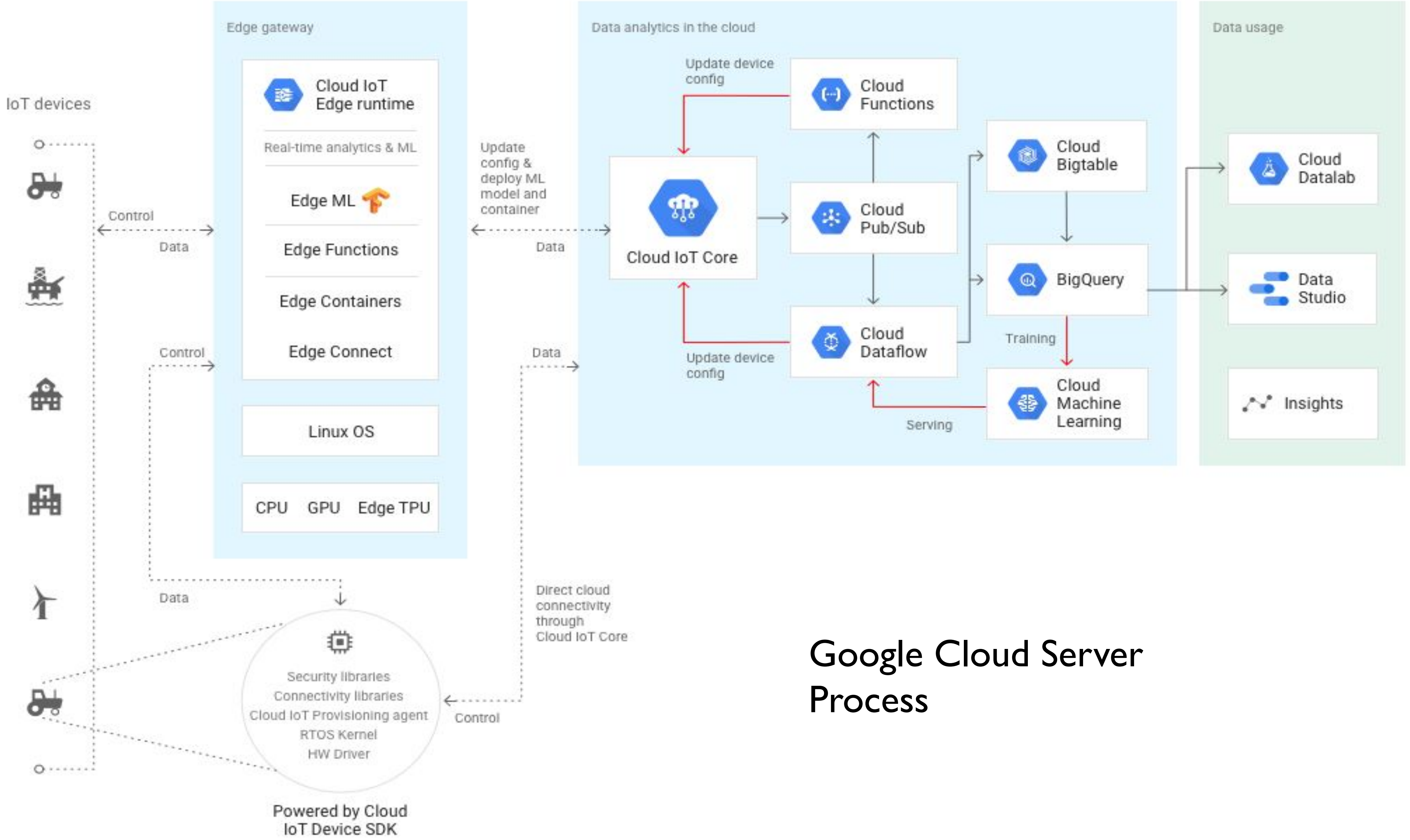


Level 1 Block Diagram

END PRODUCT DESCRIPTION

Module	Control Unit	Sensors	Cloud/Local Storage	User Interface
Input	DC Power Signal (5V ~ 2A)	Visual Images	Visual Data from Camera for training and inferences.	Google Cloud IoT Core for data
Output	Control Power Signal (5V)	Visual images from Raspberry Pi Camera	Generate Tensorflow Lite Data from Visual data	Google Cloud IoT Core, Google Cloud Datalab, Data Studio
Functionality	This allows the device to be powered on by solar panel or external battery.	Camera records specific species in surrounding environment.	Securely stores every instance into Google Cloud for batch training and interferencing.	Google Cloud IoT Core, Insights

Level 1 Functionality



Google Cloud Server Process

END PRODUCT DESCRIPTION

Module	Control Unit	Sensors	Cloud/Local Storage	User Interface
Input	Nvidia Jetson Nano with DC signal 5V - 2A Google Coral Dev Board (5V - 3A) Raspberry Pi Zero (5V - 1A) Raspberry Pi 4B (5V - 2.5A)	Controlled Power Signal (5V - 2A) Raspberry Pi Camera	Secure Device Connection and Management, Two-way Communication with all devices. Brings ML to Edge for inferencing.	Google Cloud IoT Core for data visualization from sensor visual data.
Output	Control Power Signal (5V)	Visual images from Raspberry Pi Camera are sent to GC IoT Core	Records data from RPi Camera to send to Cloud IoT Core.	USe GC IoT Core for visual representation with charts and graphs. Datalab, Data Studio, Insights.
Functionality	Main component of Bioverse 3, IoT on board wifi, Edge TPU for inferencing.	Used to record visual images from RPi Camera from ecosystem.	Securely stores the visual data to GC IoT Core.	Real-time display from GC IoT Core with graphs and charts.

Level 2 Functionality

END PRODUCT DESCRIPTION

Nvidia Jetson Nano

GPU	128 Core Maxwell 472 GFLOPs (FP16)
CPU	4 core ARM A57 @ 1.43 GHz
Memory	4 GB 64 bit LPDDR4 25.6 GB/s
Storage	16 GB eMMC
Video Encode	4K @ 30 | 4x 1080p @ 30 | 8x 720p @ 30 (H.264/H.265)
Video Decode	4K @ 60 | 2x 4K @ 30 | 8x 1080p @ 30 | 16x 720p @ 30 | (H.264/H.265)
Camera	12 (3x4 or 4x2) MIPI CSI-2 DPHY 1.1 lanes (1.5 Gbps)
Display	HDMI 2.0 or DP1.2 | eDP 1.4 | DSI (1 x2) 2 simultaneous
UPHY	1 x1/2/4 PCIE 1 USB 3.0
SDIO/SPI/SysIOs/GPIOs/I2C	1x SDIO / 2x SPI / 5x SysIO / 13x GPIOs / 6x I2C

END PRODUCT DESCRIPTION

Google Coral Dev Board

The specifications for the **Edge TPU Module** are as follows:

- **CPU**: NXP i.MX 8M SOC (quad Cortex-A53, Cortex-M4F)
- **GPU**: Integrated GC7000 Lite Graphics
- **Coprocessor**: Google Edge TPU
- **RAM**: 1GB LPDDR4
- **Flash memory**: 8GB eMMC
- **Connectivity**: Wi-Fi 2×2 MIMO (802.11b/g/n/ac 2.4/5GHz) Bluetooth 4.1
- **Dimensions**: 48 x 40 x 5mm

The baseboard has its own set of specifications:

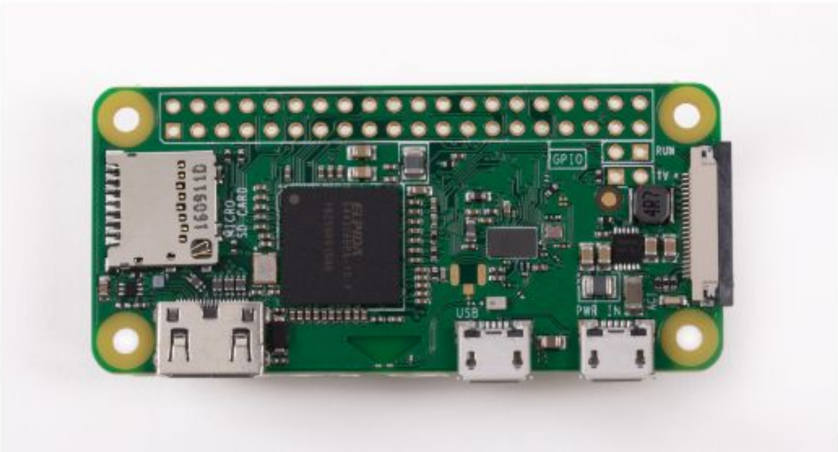
- **Flash memory**: MicroSD
- **USB**: Type-C OTG Type-C power Type-A 3.0 host Micro-B serial console
- **LAN**: Gigabit Ethernet port
- **Audio**: 3.5mm audio jack (CTIA compliant) Digital PDM microphone (x2) 2.54mm 4-pin terminal for stereo speakers
- **Video**: HDMI 2.0a (full size) 39-pin FFC connector for MIPI-DSI display (4-lane) 24-pin FFC connector for MIPI-CSI2 camera (4-lane)
- **GPIO**: 3.3V power rail 40 – 255 ohms programmable impedance ~82 mA max current
- **Power**: 5V DC (USB Type-C)
- **Dimensions**: 88 x 60 x 24mm

END PRODUCT DESCRIPTION

Specifications

Raspberry Pi Zero

- **Dimensions:** 65mm × 30mm × 5mm
- **SoC:** Broadcom BCM2835
- **CPU:** ARM11 running at 1GHz
- **RAM:** 512MB
- **Wireless:** 2.4GHz 802.11n wireless LAN
- **Bluetooth:** Bluetooth Classic 4.1 and Bluetooth LE
- **Power:** 5V, supplied via micro USB connector
- **Video & Audio:** 1080P HD video & stereo audio via mini-HDMI connector
- **Storage:** MicroSD card
- **Output:** Micro USB
- **GPIO:** 40-pin GPIO, unpopulated
- **Pins:** Run mode, unpopulated; RCA composite, unpopulated
- Camera Serial Interface (CSI)



The Raspberry Pi 4 specs

1. CPU – Broadcom BCM2711, Quad core Cortex-A72 (ARM v8) 64-bit SoC @ 1.5GHz
2. RAM – 1GB, 2GB or 4GB LPDDR4-2400 SDRAM (depending on model)
3. WiFI – 2.4 GHz and 5.0 GHz IEEE 802.11ac wireless, Bluetooth 5.0, BLE
4. Ethernet – Gigabit
5. USB – 2 USB 3.0 ports; 2 USB 2.0 ports
6. GPIO header – Raspberry Pi standard 40 pin
7. HDMI – 2 × micro-HDMI ports (up to 4kp60 supported)
8. Display port – 2-lane MIPI DSI
9. Camera port – 2-lane MIPI CSI
10. Audio – 4-pole stereo audio and composite video port
11. Storage – Micro-SD card slot for loading operating system and data storage
12. Misc – H.265 (4kp60 decode), H264 (1080p60 decode, 1080p30 encode), OpenGL ES 3.0 graphics
13. OS – Debian Linux 10 based

END PRODUCT DESCRIPTION

- End Product Description
- Functions
- Specifications
- Other Deliverables
  - Code with be managed by GCP, and Git
  - Working concept showing the entire process in action
  - Google Cloud Platform for device scalability and maintenance.

CONCLUSION

- Globalization
- Standards Considerations
- Feasibility Analysis
- Risk Analysis
- Plan of Action
- Multidisciplinary Aspects
- Personnel
- Budget
- End of Product Description