PRINCE MOHAMMAD BIN FAHD UNIVERSITY
DEPARTMENT OF ELECTRICAL ENGINEERING

RED PALM WEEVIL DETECTION AND TRACKING SYSTEM

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NADA BATTYOUR 201600504
SHURUQ FALLATAH 201700952

Advisor: Dr. Sadiq Ali Alhuwaidi
CO-Advisor: Mr. Ahmed Abul Hussain

May 17th 2022

Presentation Outline

- Project Definition
- Project Objectives
- Project Specifications
- Project Constraints and Engineering Standards
- Project Architecture
- Planning
- Background & Previous Projects
- Design: Subsystems and Component Selection Testing
- Project Management & Team Work Impact of Project
- New Skills Acquired and Applied
- Completed and Remaining Work Budget Estimate
- References

Project Definition

Design a smart system that can detect the Red Palm Weevil inside the palm and track its presence in each specific area. The system will have subsystems to monitor the number of weevils, detect their motion, and update their presence.

Project Objectives

- Detecting The Red Palm Weevil Until Appropriate Action Is Taken.
- Preventing And Reducing The Increase Of The Red Palm Weevil.
- Preserving The Palm And Its Crops And Rescuing Adjoining Farms.

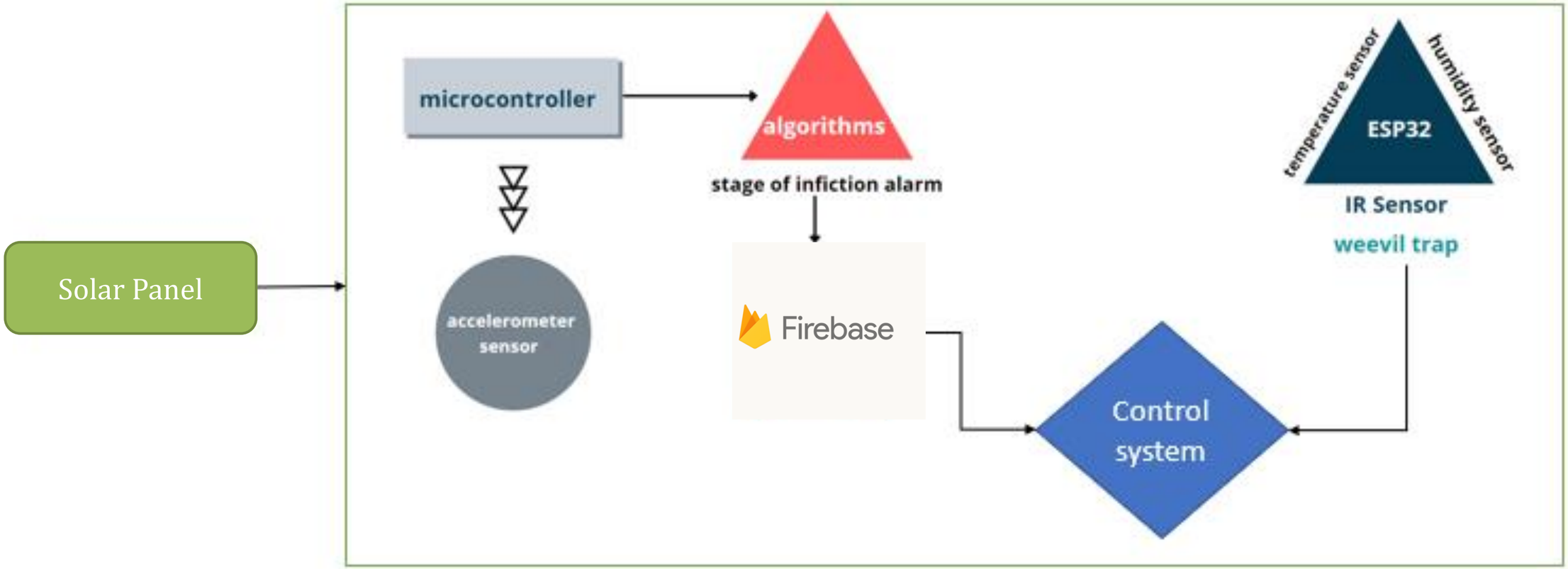
Project Specifications

- Monitor a cluster of traps by identifying and estimating the infected area within a radius of 25 m via algorithms.
- Detect weevils inside the palm trunk using a sensor.
- Update regularly the farmer about weevil’s infestation for each cluster and palm using a wireless communication system.

Design Constraints & Standards

- 24-hours notification
- Data accuracy
- Low- Budget
- Environmentally friendly
- Accessible and easy to use

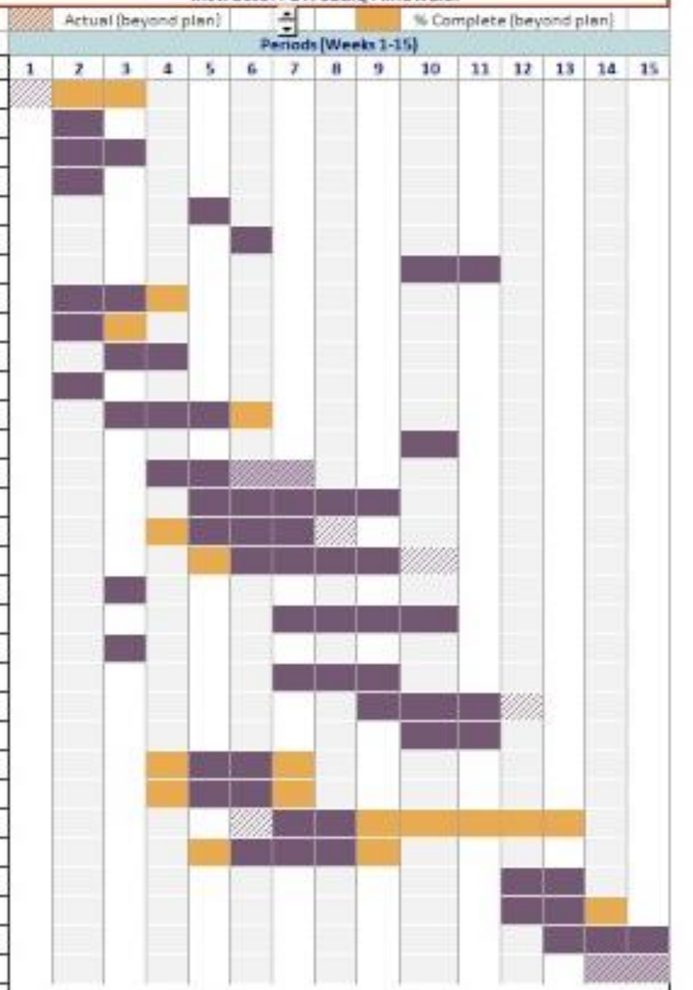
Project Architecture



Planning

Title: Red Palm Weevil Detection and Tracking System	Advisor & Co-Advisor: Dr. Sadiq Alhuwaidi, Mr. Ahmed Abul Hussain	Design II (ASSE 3)	Spring 2022
Nada Battyour (NB) 201600504		Project PLAN & Progress	
Razan Alzaben (RZ) 201701278		ProgRpt No. 6	
Shuruq Fallatah (SF) 201700952		Plan updated (Date): May. 17, 2022	
Haneen Quraishi (HQ) 201302442		Instructor: Dr. Sadiq Alhuwaidi	

ACTIVITY	PLAN START	PLAN DURATION	Assigned To	ACTUAL START	ACTUAL DURATION	PERCENT COMPLETE
Write a Plan	1	1	ALL	2	2	100%
Ordering Components for Subsystems	2	1	ALL	2	1	100%
Design subsystem 1 (Weevils Tracking)	2	2	SF	2	2	100%
Hardware Connection	2	1	RZ,SF	2	1	100%
Designing the Altium PCB	5	1	RA	5	1	100%
Printing the PCB	6	1	RA	6	1	100%
Designing and Printing the 3D Funnel	10	2	SF	10	2	100%
Implement Code	2	2	SF	2	3	100%
Test Subsystem 1	2	1	ALL	2	2	100%
Design subsystem 2 (Weevils Palm Detecting)	3	2	RZ,NB	3	2	100%
Hardware Connection	2	1	RZ,NB	2	1	100%
Implement the BMA400 Sensor Code	3	3	RZ	3	4	100%
Implement the DHT11 Sensor Code	10	1	RA	10	1	100%
Integrate All Sensors	4	4	NB	4	4	65%
Test Subsystem 2	5	5	ALL	5	5	100%
Prepare midterm presentation and video	5	4	ALL	4	4	100%
Design Subsystem 3 (Communication System)	6	5	ALL	5	5	100%
Hardware Connection (Weevils Tracking)	3	1	SF	3	1	100%
Implement Code Weevil Tracking	7	4	SF	7	4	100%
Hardware Connection (Weevils Detecting)	3	1	RZ	3	1	100%
Implement Code Weevil Detecting	7	3	RZ	7	3	100%
Integrate All Subsystems	9	4	RA,SF	9	3	100%
Test Subsystem 3	10	2	ALL	10	2	100%
Design Subsystem 4 (Solar Cells)	5	2	HQ	4	4	100%
Order Cells	5	2	HQ	4	4	100%
Hardware Connection	6	3	HQ	7	7	100%
Test Subsystem 4	6	3	ALL	5	5	100%
Prepapre final report	12	2	ALL	12	2	100%
Prepapre final presentation	12	2	ALL	12	3	100%
Prepare project demo	13	3	ALL	13	3	100%
Submit Rpt/PPT/Brochure/Video...etc.	14	2	RZ	14	2	0%



Planning

electrap

مؤتمر تمكين المرأة ودورها التنموي في عهد الملك سلمان

Conference of Women Empowerment and Their Developmental Role in the Reign of King Salman

وزارة البيئة والمياه والزراعة

Ministry of Environment Water & Agriculture

Kingdom of Saudi Arabia المملكة العربية السعودية

Planning

Background
Problems & Solutions

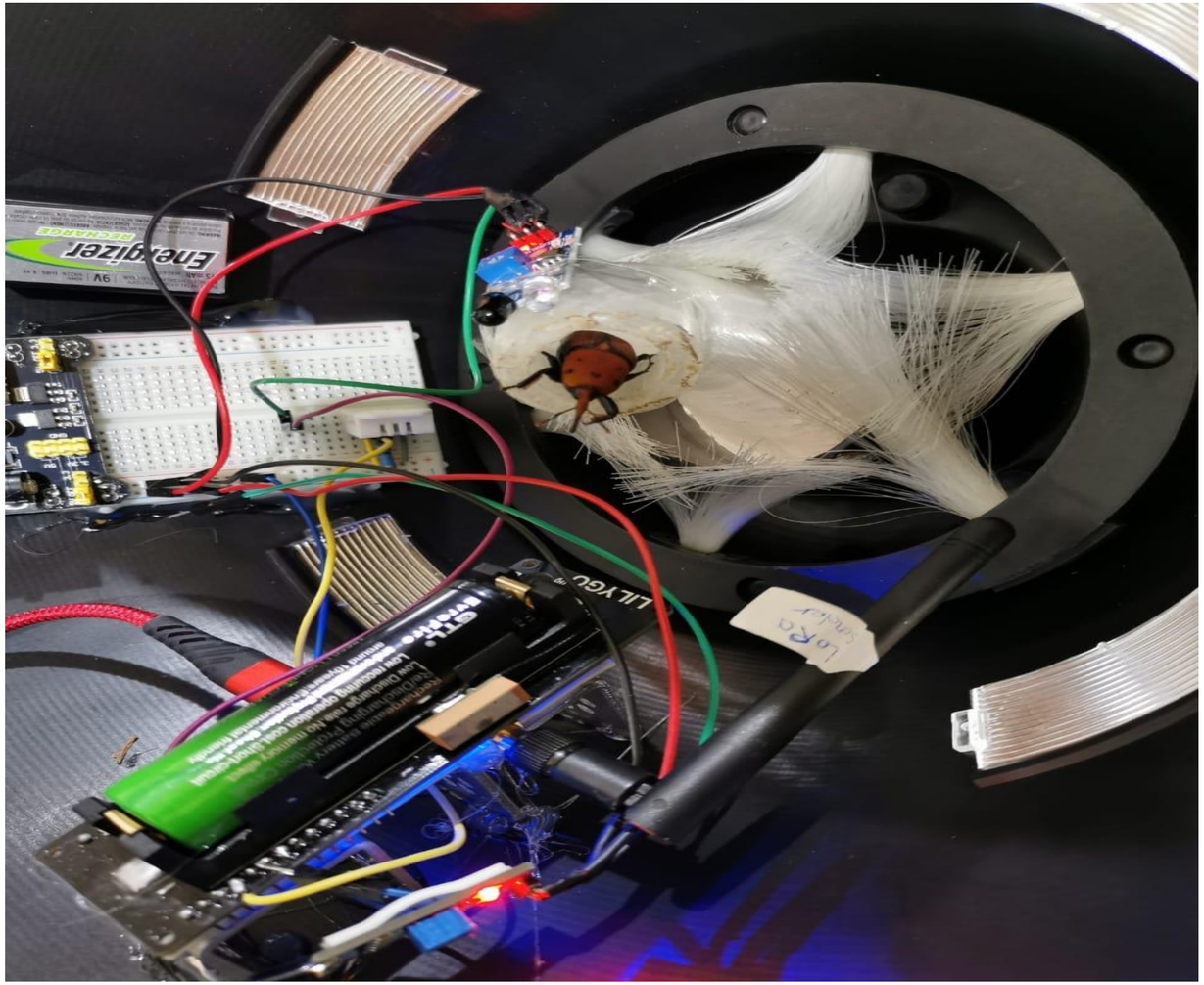
Traditional Ways

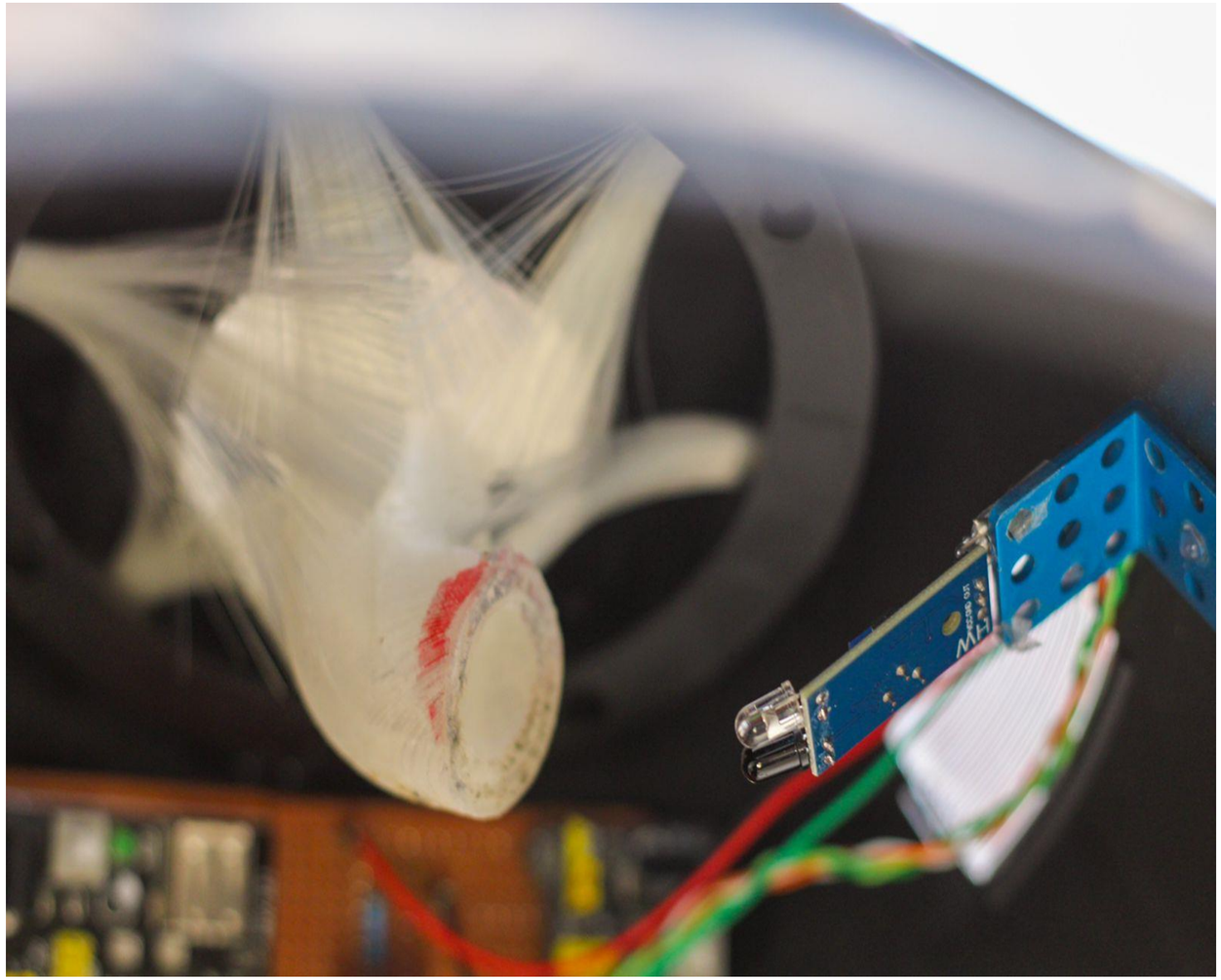
1. Trained dogs by farmers for discovering the odor released.
2. Chemical gases.

Scientific Methods

1. IR thermal cameras.
2. Laser-induced breakdown spectroscopy (LIBS).
3. X-Ray is used to detect the early stages of RPW.

New Structure





Design: Weevils Tracking Sub-system

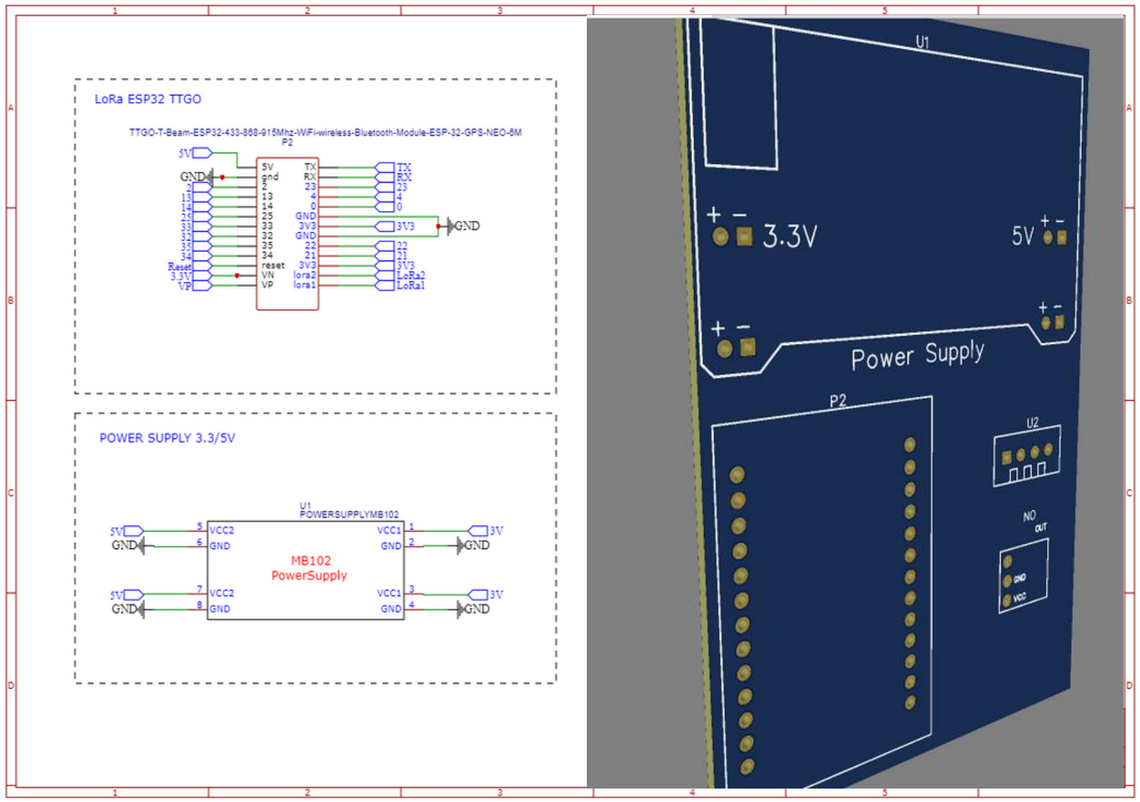


Figure A: Schematic Diagram

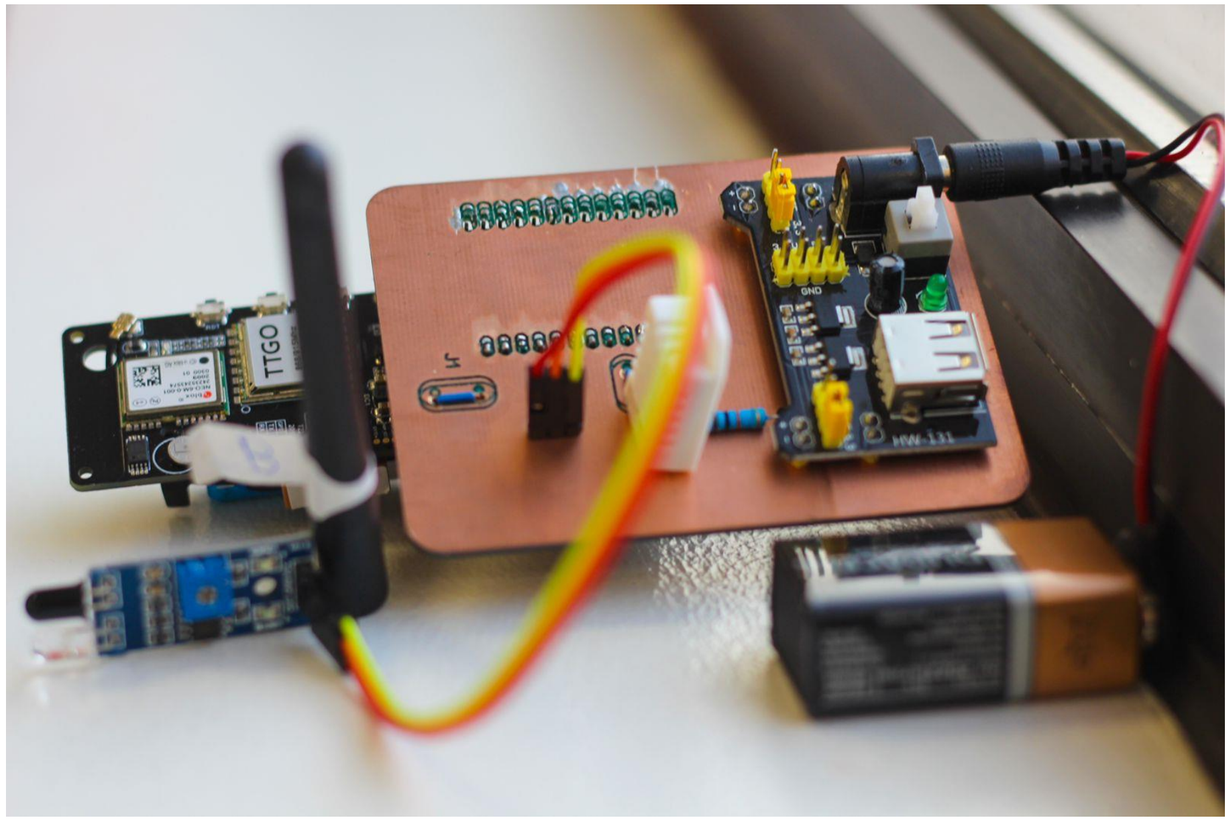
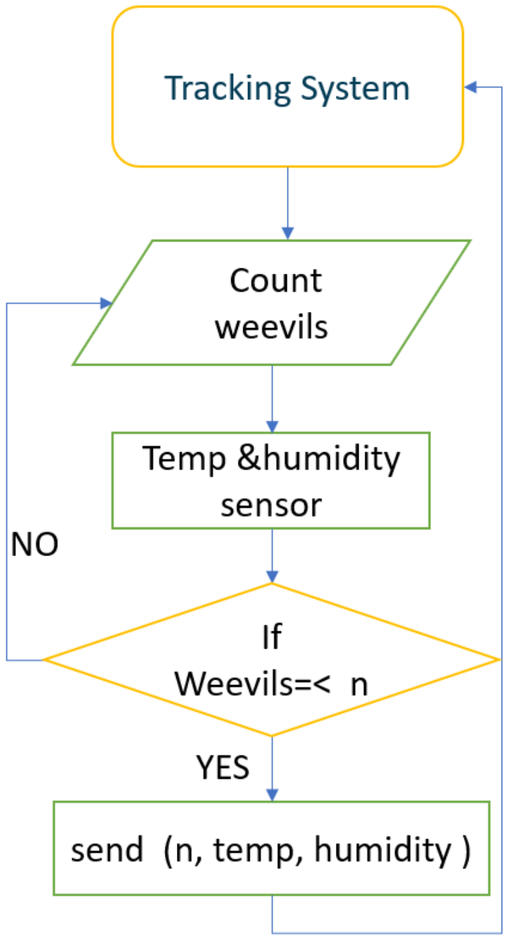
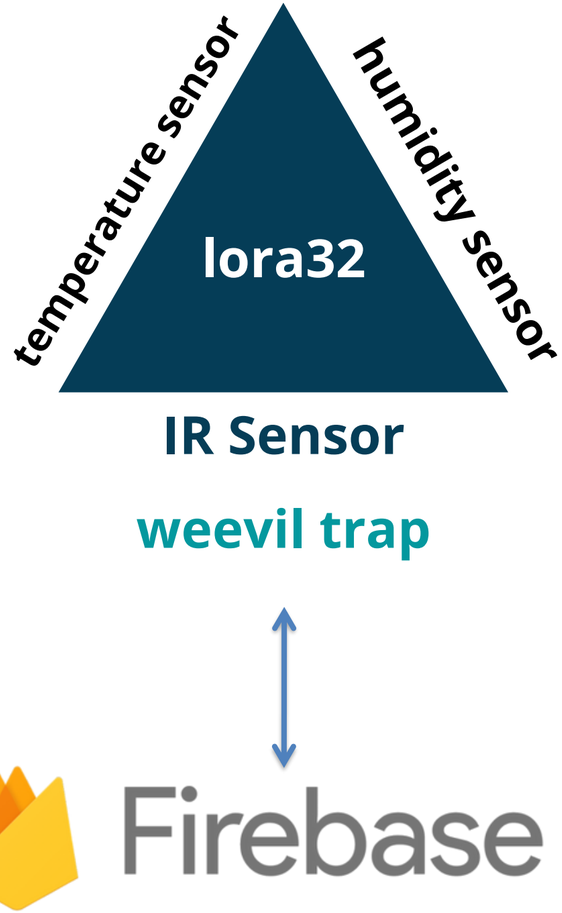


Figure B: PCB 3D

The PCB Design By Altium

Weevils Tracking Using WIFI





Weevils Tracking Using LoRa

ESP32, WIFI, Bluetooth , 3D Antenna ,GPS

Operating frequency: 915 MHz

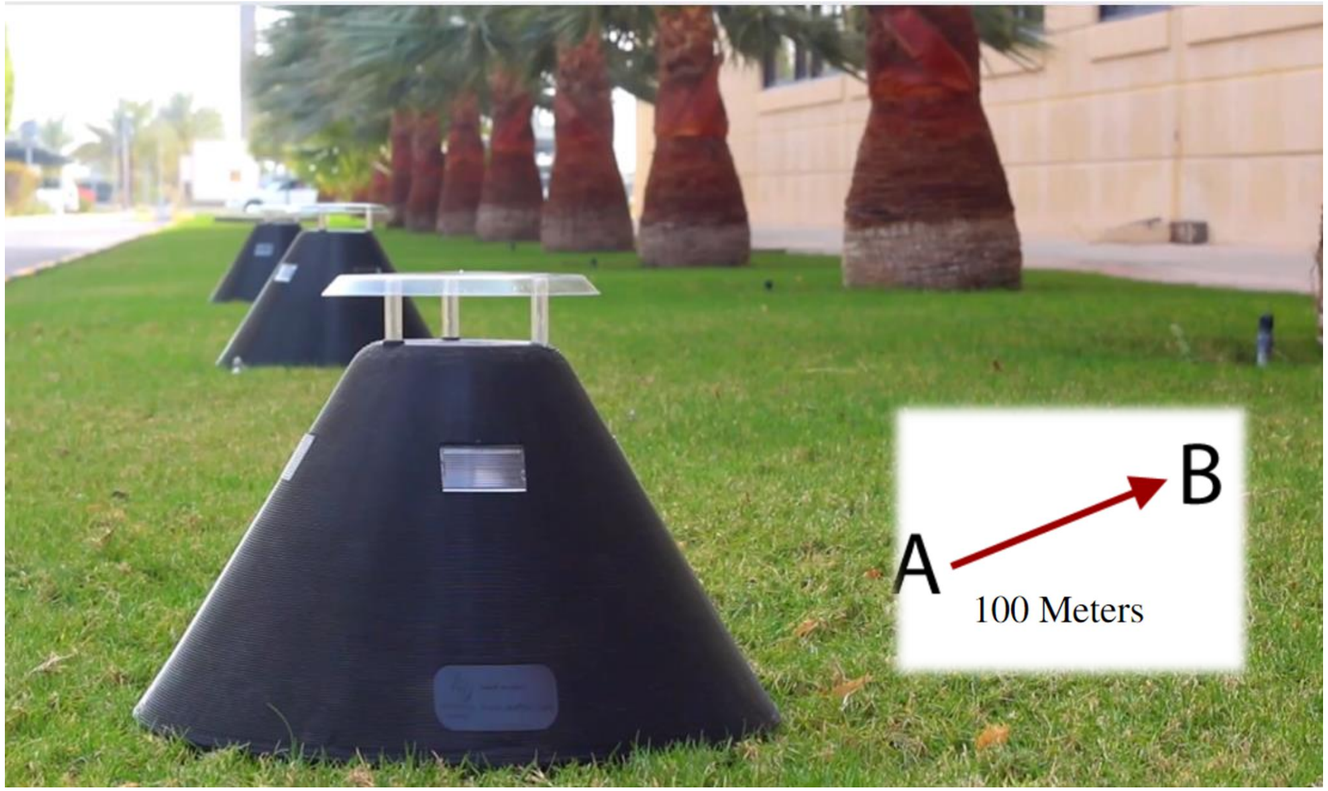
Transmit power: +20dBm

Receive sensitivity : -139dBm@LoRa &

10 MILES

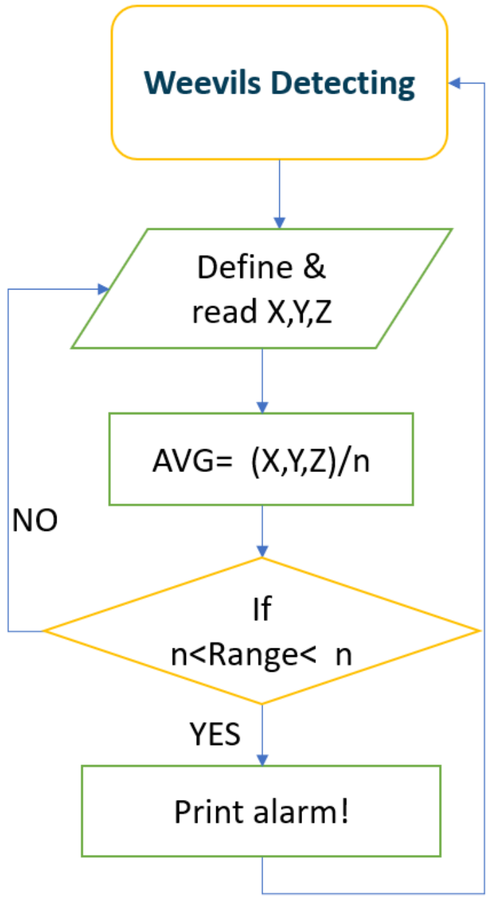
=

16093.44 METERS

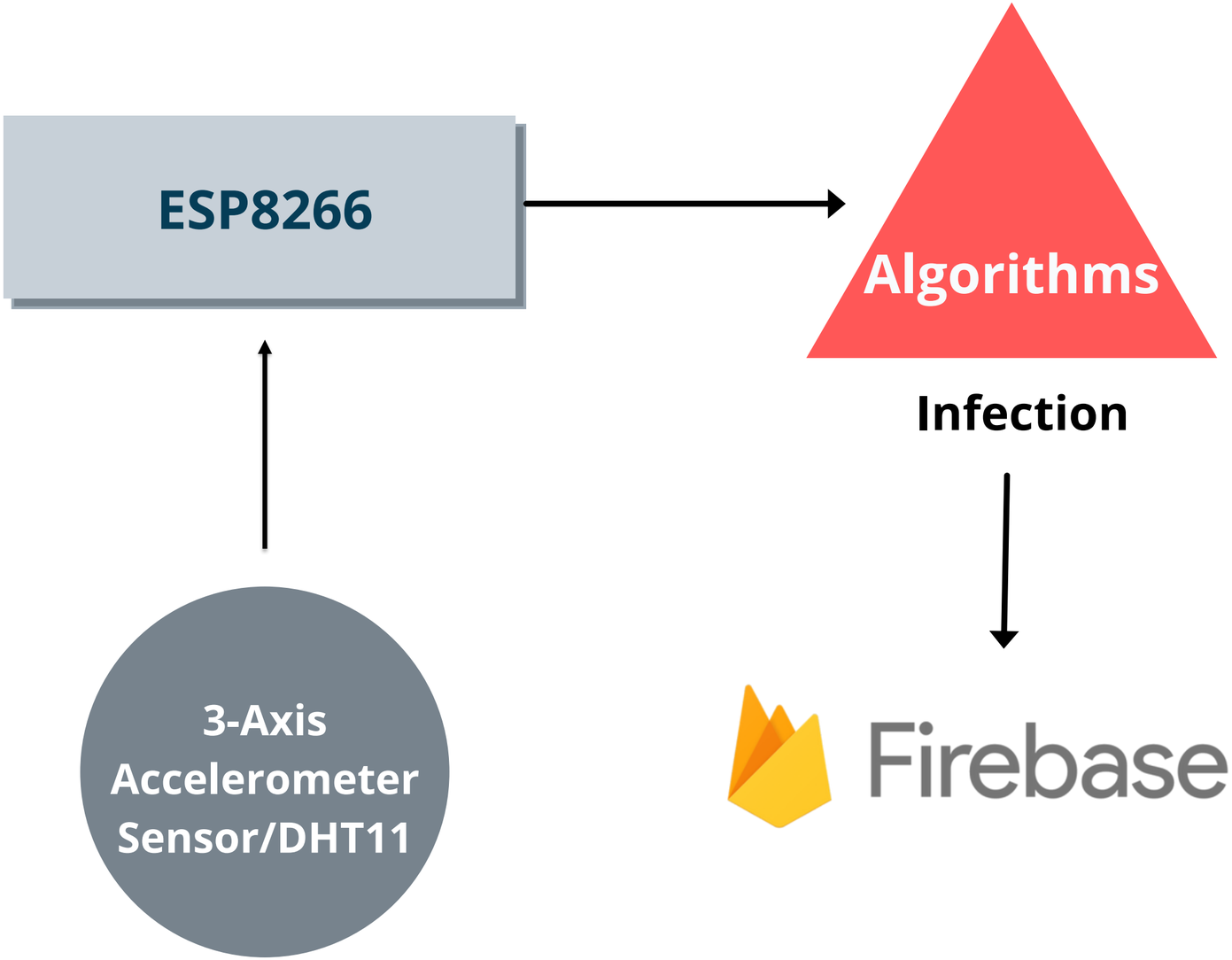


Weevils Tracking Using Alarm Email

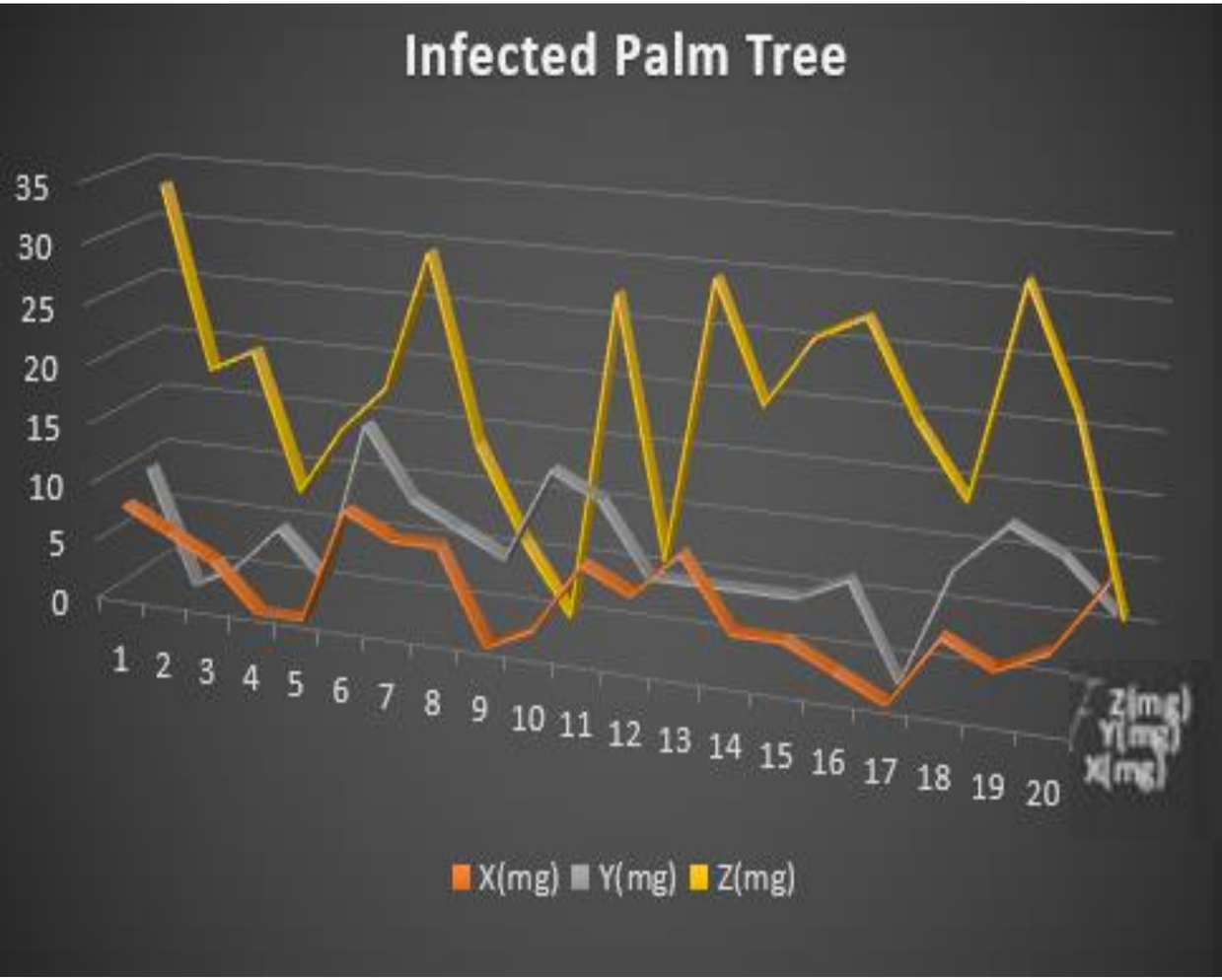
Design: Weevils Detecting Sub-system

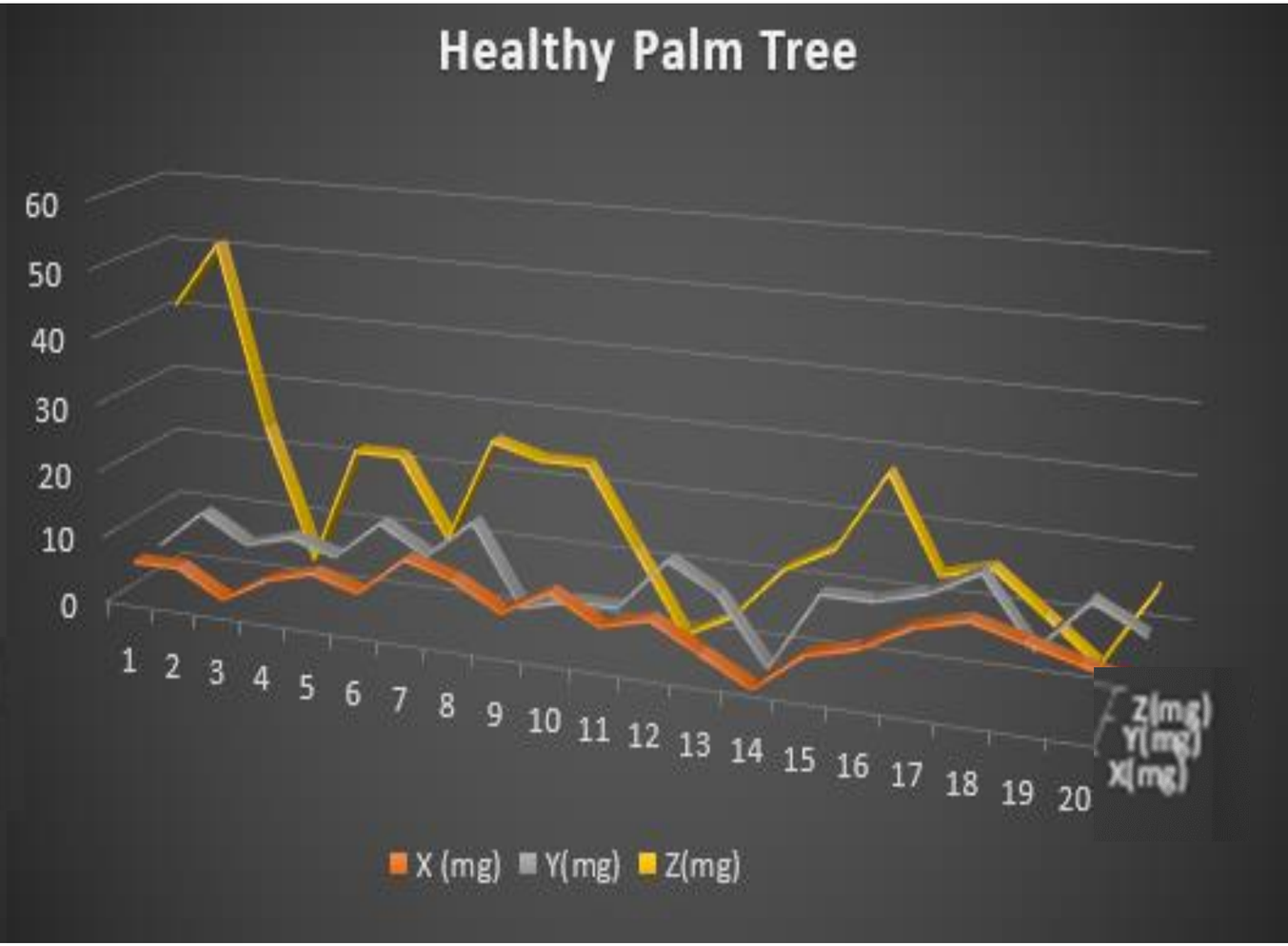


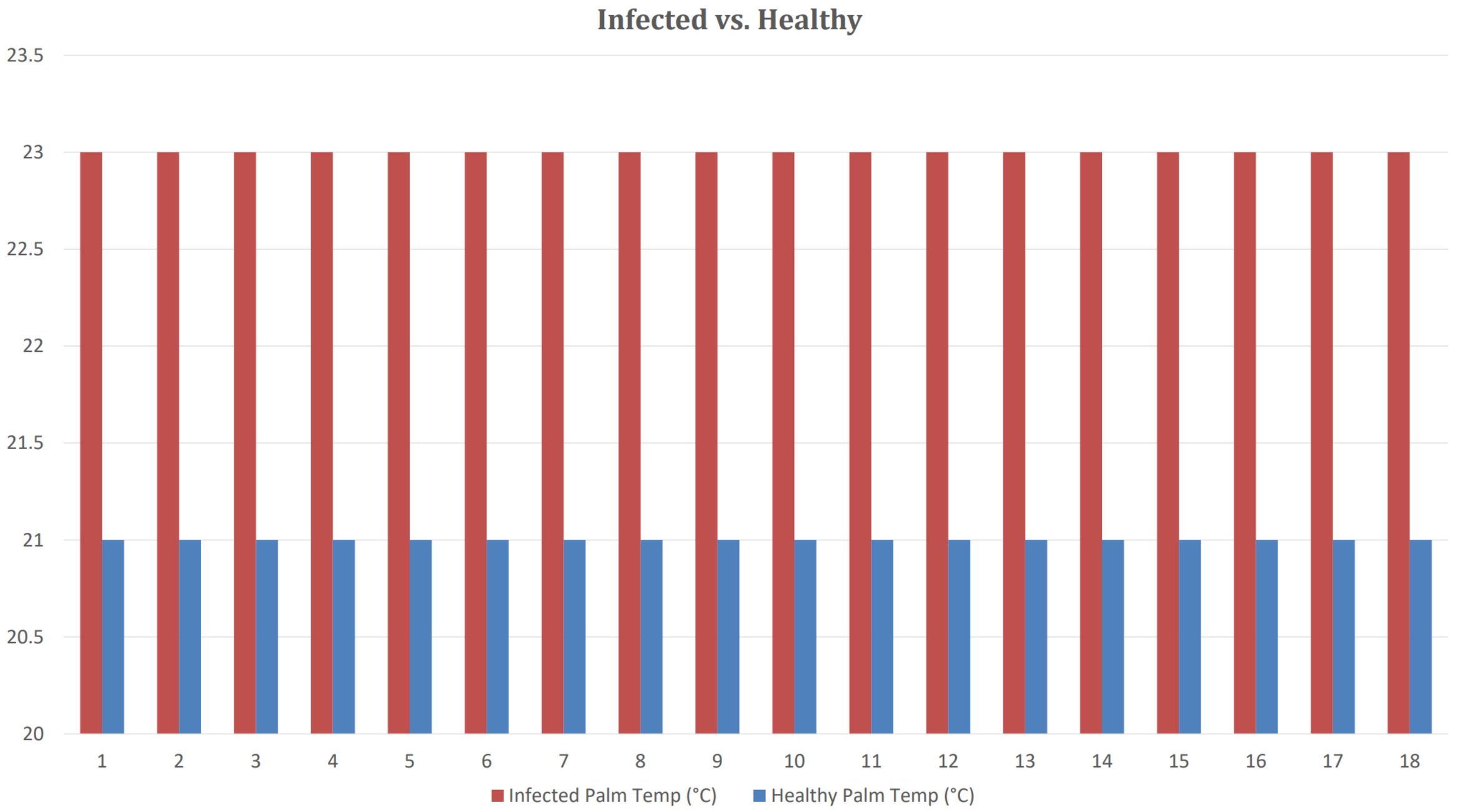
Pseudocode



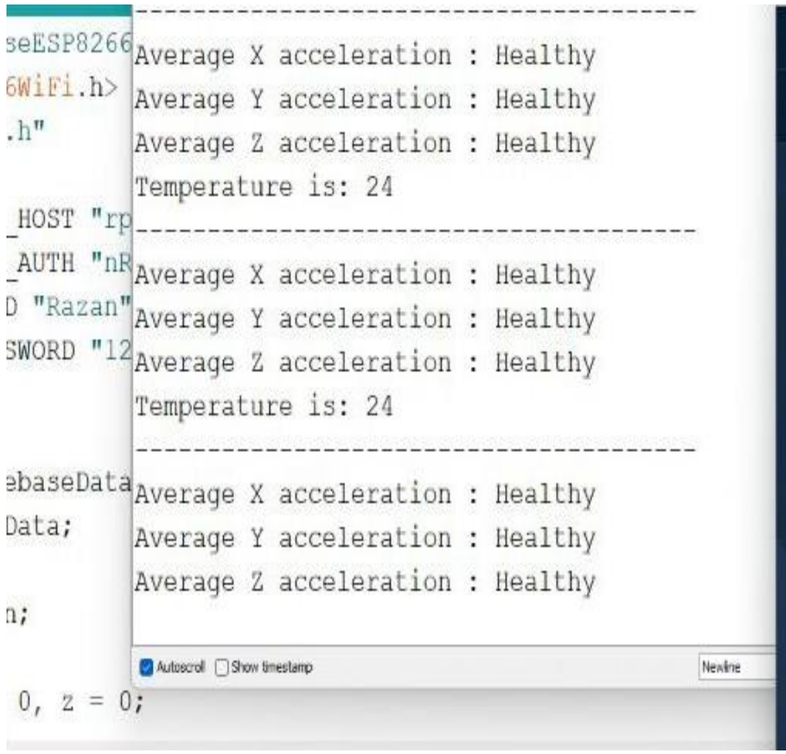
Sensor Data Collecting

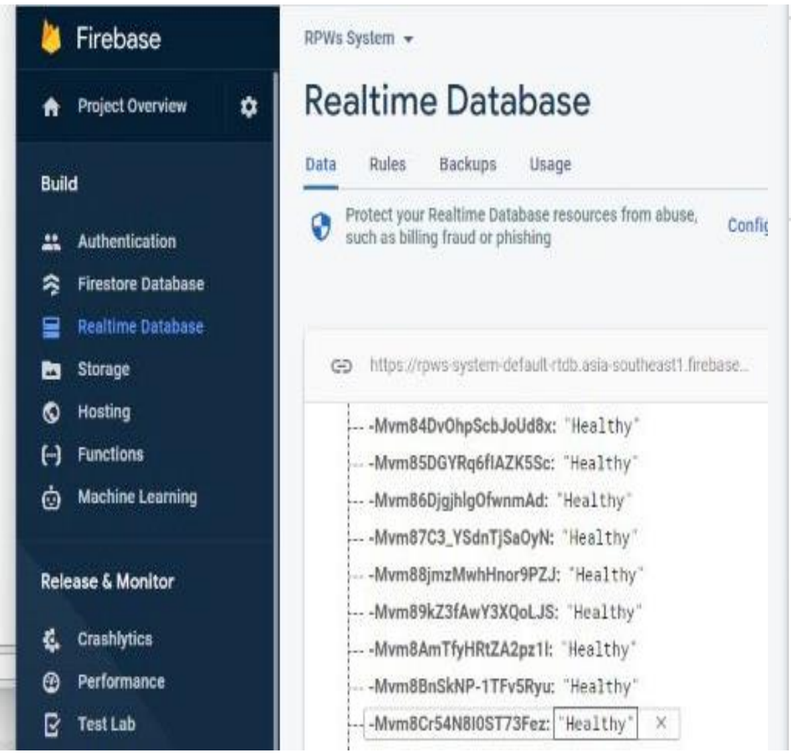


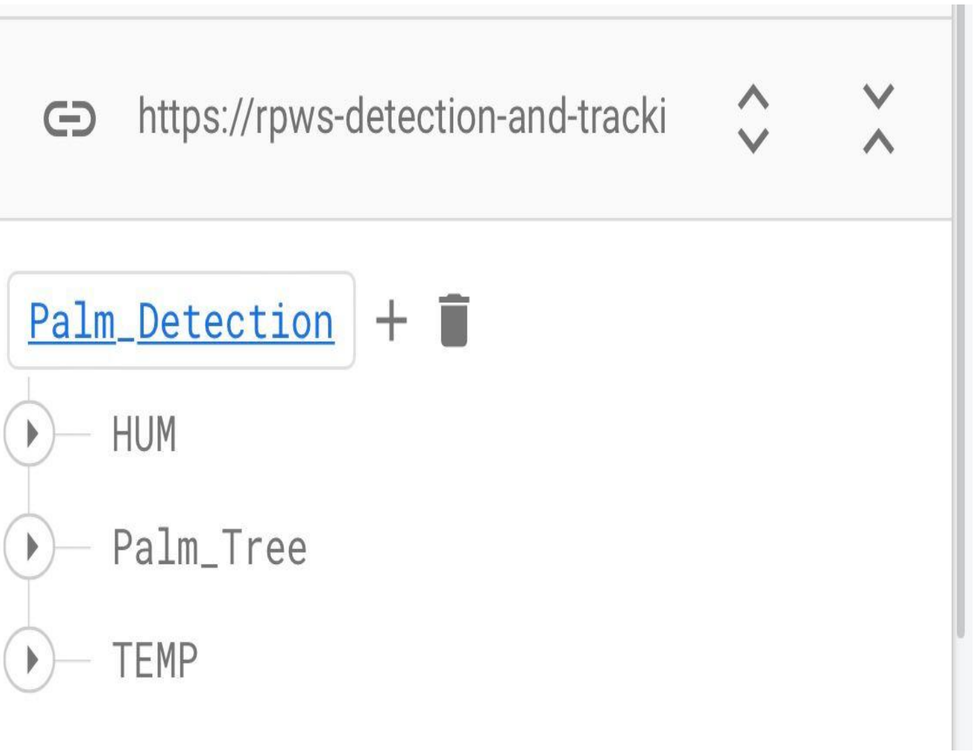


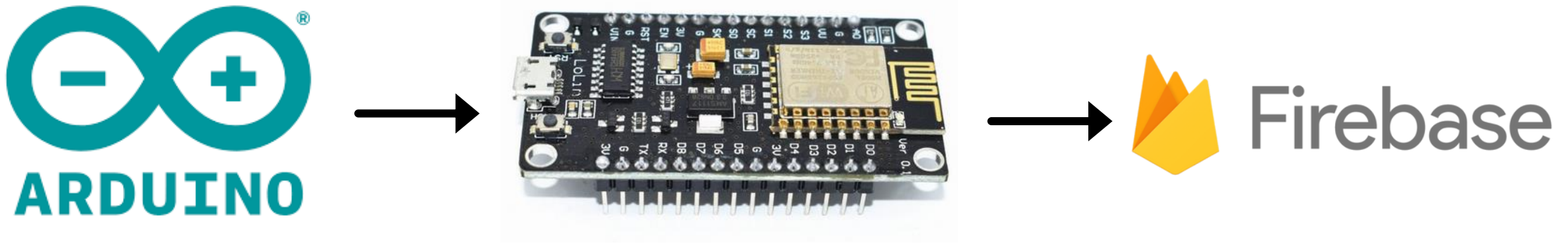

Infected vs. Healthy
23.5
23
22.5
22
21.5
21
20.5
20
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
Infected Palm Temp (°C)
Healthy Palm Temp (°C)

ESP8266 NodeMCU

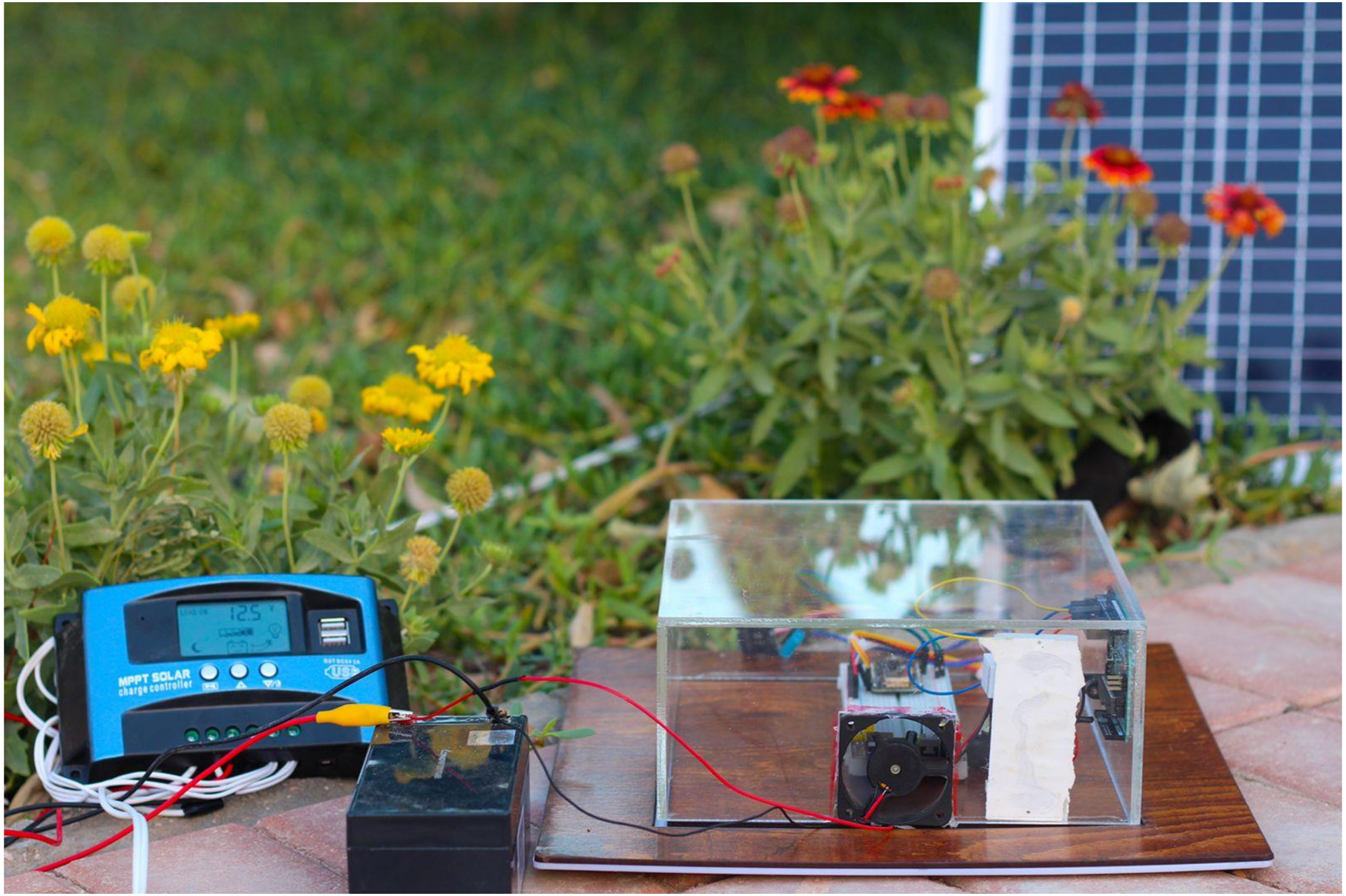






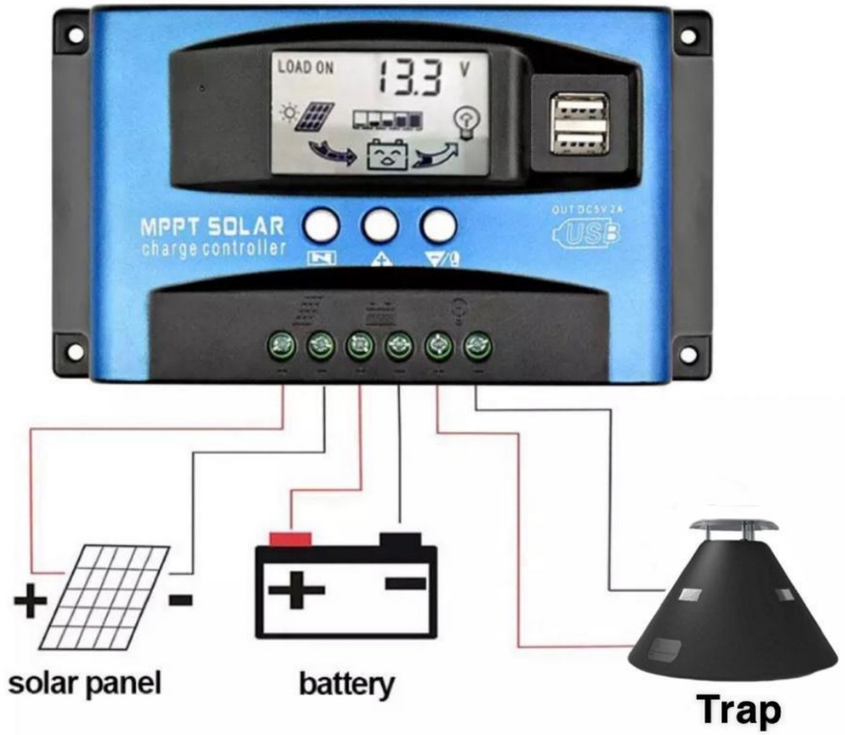


Circuit Cooling Box



Design Solar Panel Sub-system

- 12V Battery
- Charge Controller
- Solar Panel



Project Management & Team Work

Project Management & Team Work

- **Team work task division**

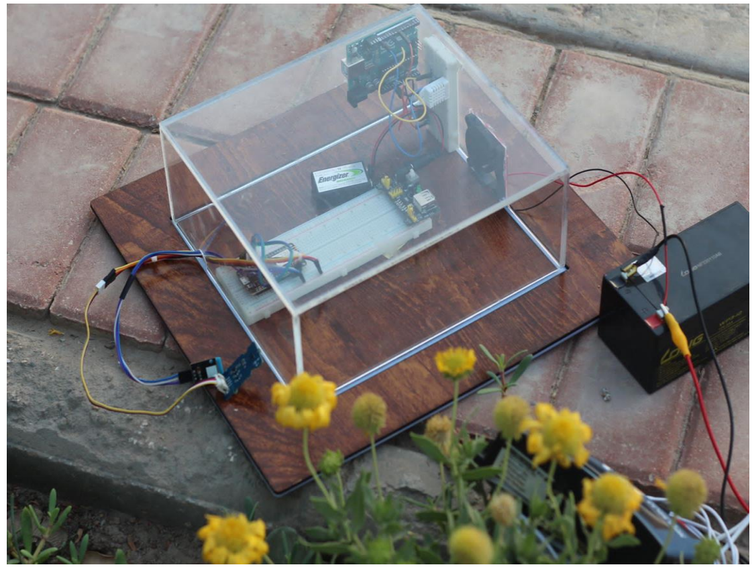
Task	Haneen	Shuruq	Razan	Nada
Search & acquire components	25%	25%	25%	25%
Design & Implement Subsystem 1	5%	65%	30%	0%
Design & Implement Subsystem 2	0%	30%	65%	5%
Design & Implement Subsystem 3	0%	50%	50%	0%
Design & Implement Subsystem 4	60%	20%	20%	0%
Testing	25%	25%	25%	25%
Write Reports & Presentations	25%	25%	25%	25%

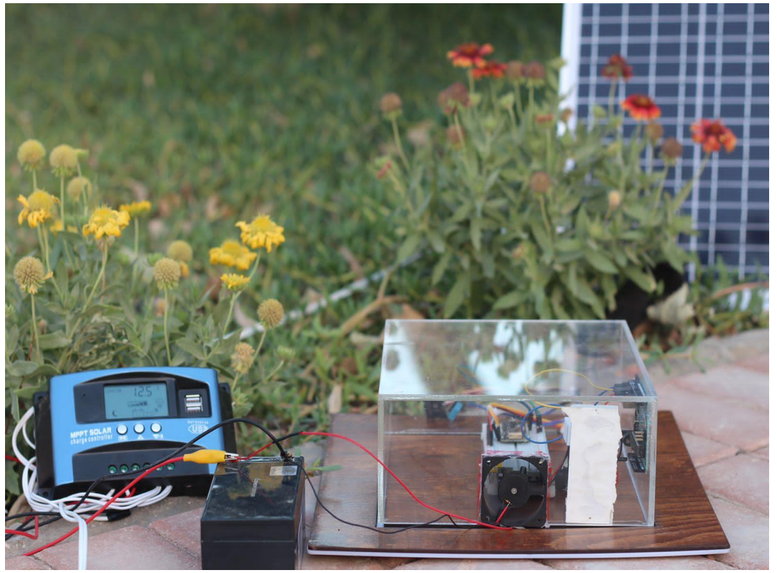
Project Management & Team Work

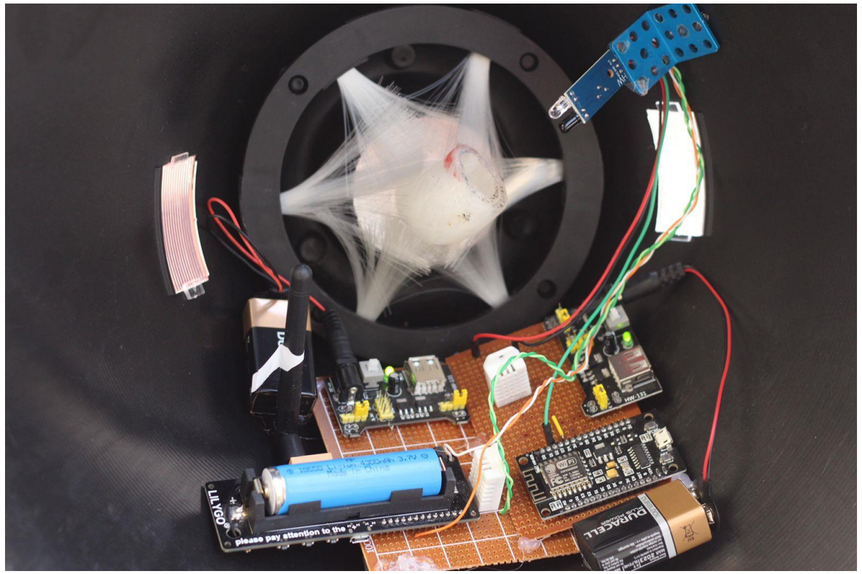
#	Risk Description	Risk Management	Impact
1	Programming	Having meetings with advisor	Project Scope
2	Infected farm	communicating with the Ministry of Environment & Agriculture	Delays
3	PCB design	Communicating with the designer	Delays
4	3D design	Communicating with the designer	Delays

Completed Work

Designed and connected all the subsystems.







Impact of Project

- Protects and preserves the palm to have less impact on the economy of agriculture
- Reduces the use of chemicals
- Cost efficient
- Reduces the workforce
- More reliable
- Controls of weevil

New Skills Acquired and Applied

- Understand the behavior of Palm Weevils in Reality
- Designing the PCB using Altium Designer
- Programing
- Time Management

Cost

No.	Description	Quantity	Unit Cost (SAR)	Total Cost (SAR)
1	Arduino	5	95.50	477.5
2	Weevils Trap	4	250	1000
3	BMA400 Accelerometer	4	36.75	147
5	ESP32 Module	4	20.45	81.8
6	ESP8266 Module	2	39	78
8	IR Sensor	3	14	42
9	Breadboard Power Supply	4	11	44
10	I2C Multiplexer (TCA9548A)	5	23.2	116
11	LoRa	3	225.907	675.29
12	Charge Controller	1	136	136
13	12V Battery	1	100	100
14	Breadboard	3	17	51
The Total Cost				2948.59

Thank You!

References

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Mohammed, M.; El-Shafie, H.; Alqahtani, N. Design and Validation of Computerized Flight-Testing Systems with Controlled Atmosphere for Studying Flight Behavior of Red Palm Weevil, Rhynchophorus ferrugineus (Olivier). Sensors 2021.