**Mine-detection Drone**

Project Analysis

**Project Charter Elements**

**Official project name:**

**Mine-detection Drone**

**Project sponsor and its contact information:**

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**Purpose of the project:**

Detecting and extracting mines at the lowest cost and less harmful than the usual and recognized methods. And make the most of the arable land in the desert, which has a large amount of mines. We are talking about 22% of Egypt's total area in the western desert region of Egypt, which was already called the "food basket of the Roman Empire". UN missions now estimate that 19.7 million mines are left over from the Battle of El Alamein beneath its sands, which have been inhabited by death for 70 years. This is not the same as a million other mines in Sinai Obstacles to achieving a growth boom in the areas in which it exists, whether by reclaiming land for agricultural purposes or using it for tourist attractions or exploring its mineral resources. Through this project, we can contribute a large percentage of getting rid of this mine at the lowest cost and highest quality.

**Business case for the project:**

First let's start with…

**1-Locations of mines in Egypt are divided into two main fields, as follows: -**

A) Landmine fields in Western Desert:

The Western Desert mine fields extend from Alamain up to the Egyptian-Libyan borders with a depth of more than 40 km from the Mediterranean coast. Landmines planted in these fields vary in type and size depending on the troops involved in action. They are spread in ten fields as follows:

-The coastal strip on both sides of Alexandria-Matrouh road.

-The field starting 10 km on Abu-Doues road of Borg el-Arab, al-Alamain, a-Daba and Bagos (Gala).

-The fields of Nweider, Rwaisat and al-Marir, the most dangerous mine fields, where no mine maps were found. Here, dozens were killed and injured.

-The fields of al-Manaseb and Dair al-Qatany involving vast areas of arable land.

-The fields of al-Khawabeer, Dair-a-Ragel and al-Osayed which are among the most dangerous fields where mines are widely spread.

-The field of Bab al-Qatara 30 km, on Alamain - al-Humaymat road.

-The fields of Abu Dwis, Halq ad-Daba Zahr el-Hammad and al-Humaymat.

-Borg Raqabet al-Ralah; where all kinds of mines are found.

-The fields of Fuka and West of Marsa Matrouh up to the Egyptian-Libyan borders.

B) Mine fields in Egypt’s Eastern Desert:

They are the fields where mines were planted as a result of Egyptian-Israeli wars that took place since 1956 to 1973, as follows:

-The field of west Suez Canal.

-The field of west Suez Gulf.

-The field of west Red Sea.

-The South Sinai Field.

-The Central Sinai Field.

-The North Sinai Field.

**2-The cost of removing mines by ordinary methods: -**

1- Mine manufacturing cost from 3 to 30 dollars.

2- The cost of removing the mine ranges from $300 to $1,000.

3- The cost of removing all mines (about 110 million mines) from 50 to 100 billion dollars.

**3-The latest methods used in mine clearance so far: -**

1- a new mine clearance technology, based on ground penetrating radar. In the long run, they are aiming at creating a handheld device that will detect different mine types on rough terrain without fail and which can be used in the same way as metal detectors.

2- use of metal detectors: -

Made of plastic, metal, or other materials, mines contain explosives and sometimes pieces of shrapnel, that is why you use metal detectors.

3- Use of robots: -

The use of robots speeds up the demining process, avoids demining experts from direct physical contact with mines, and reduces the incidence of injuries.

PEMEX-B, the first demining robot is a multi-mode, portable, low-cost robot, with wheels on a mountain bike that can be adapted using local materials such as bamboo or other appropriate local resources.

**4-****What new will the project add?**

The project will reduce the risks resulting from removing mines by normal methods, as it works by remote control using modern techniques in detecting mines, such as thermal sensors.

**Key deliverables of the project:**

The project will make a qualitative leap in the techniques used in removing mines, as it will reduce the risks resulting from extracting mines from the ground

This will lead to extracting the largest possible amount of mines from lands and deserts, especially arable lands, and benefiting from the largest possible amount of wealth in the country.

**General statement about how the team will approach the work:**

Working as part of a team can be both rewarding and challenging. With multiple sets of skills and experience to draw on, a dedicated team makes it easier to overcome obstacles and hit targets. Yet each person needs to feel included, valued, and part of a collective. So how do you support your team at work?

Whether as a leader or a member of a team, there are several ways in which you can support those around you. As well as looking at some of the steps you can take, we also take a look at why teamwork is important in the first place.

I followed these 10 steps to be a good team.

1) Communicate regularly.

2) Check-in regularly.

3) Be inclusive.

4) Learn to prioritise.

5) Empower others.

6) Work on your emotional intelligence.

7) Set reasonable goals.

8) Take breaks together.

9) Focus on wellbeing.

10) Promote growth.

**Basic timeline of when the project milestones will be reached:**

|  |  |
| --- | --- |
| Task Name | Duration |
| Preparing the mechanical design of the drone. | 20 days |
| Drone circuit design. | 15 days |
| Preparing the code for the drone. | 7 days |
| exoskeleton industry. | 14 days |
| print electrical circuit  (PCB) | 7 days |
| Drone control industry. | 10 days |
| Total | 73 days |

**Project resources, budget, staff, and vendors:**

|  |  |
| --- | --- |
| Element | The details |
| Project resources | Online shopping companies |
| Budget | 30:35 $ |
| Staff | A group of mechanical and electrical engineers and programmers. |
| Vendors | Army companies and desert land owners. |

**Summary budget:**

|  |  |
| --- | --- |
| Task Name | Budget |
| Exoskeleton industry. | 15 $ |
| Motors and internal components. | 10 $ |
| Circle industry. | 5 $ |
| Controller industry. | 5 $ |
| Total | 35 $ |

**High level assumptions and constraints:**

-Not allowing the purchase of some internal components of the device.

-Predetermined budgets, deadlines, resources, preferred vendors, and required technology.

**High-level risks:**

- Incompatibility of the electronic chip used with the circuit.

- Delayed sensor response.

- The code is not compatible with the chip.

- Loss of control of the drone.

-There is a fear of mines exploding in the drones and thus it could cause some losses.

**Project scope statement**

**Product Scope Description:**

-The project will work in the desert and lands where there is a large amount of mines.

-The companies or organization that will buy the product will get the following: -

1- Drone with remote control.

2- A guide to using the drone.

2- Detailed description of the drone's scope of operation and the extent to which it can detect mines.

**Product Acceptance Criteria:**

The project should be as follows: -

1- Easy to use.

2- High efficiency.

3- Detects mines on a large scale.

4- High detection accuracy.

5- It has a program that can be controlled from the phone.

**Project Deliverables:**

The project will be a great development in the organization, as we will benefit from the research and experiments that we will conduct and from the design and manufacturing processes, whether it is for the external structure, the circuit, or even writing the code.

The organization will keep the following: -

1- Mechanical design: Where we will benefit from it in other manufacturing processes and other projects such as robotics.

2- Circuit design: As we are working on developing new electronic parts to make the electrical circuits that we manufacture in the future more efficient.

3- The code used to control: As we seek to add new features to control the future.

4- Design of the sensor and responsible for detecting the mine: To add new techniques to detect mines.

**Project Exclusions:**

1- The driver does not work on Linux, Mac-OS and IOS.

2- The maximum range for detecting mines is 5 square metres.

3- The drone operates in all conditions except rain and wind.

**Project Constraints:**

|  |  |
| --- | --- |
| Details | Constraint |
| We should work on a budget of 30 $ per drone. | Budget |
| The time limit for the construction of the first drone is the first of March of the new year. | Deadline |
| Amazon site. | Resources |
| Army companies. | Preferred Vendors |
| The project will work in the desert and lands with mines. | Scope |

**Project Assumptions:**

**Supposed to:**

1- Mechanical design conforms to body fabrication.

2- Circuit design conforms to PCB.

3- The chip used is compatible with the drone.

4- The code is compatible with the controller.

**Work Breakdown Structure**

**The project generally consists of:**

• 701.1 Hardware

• 701.2 Software

• 701.3 Electrical circuit

**Project component analysis:**

• 701.1 Hardware

Drone Hardware 701.1.1 √

701.1.1.1 External Hardware ‹

701.1.1.1.1 Drone propellers ▪

701.1.1.1.2 Drone wings ▪

701.1.1.1.3 The rest of the exoskeleton ▪

› 701.1.1.2 Internal Hardware

▪ 701.1.1.2.1 Motors

▪ 701.1.1.2.2 The Drivers

▪ 701.1.1.2.3 Sensors

701.1.2 Remote control Hardware √

› 701.1.2.1 External structure of the controller

• 701.2 Software

701.2.1 Drone Software √

Microcontroller › 701.2.1.1

Code › 701.2.1.2

√ 701.2.2 Remote control Software

Microcontroller › 701.2.2.1

› 701.2.2.2 Code

• 701.3 Electrical circuit

√ 701.3.1 Drone

701.3.1.1 Resistors ‹

› 701.3.1.2 Capacitors

› 701.3.1.3 Electrical Coils

√ 7.1.3.2 Remote control

701.3.2.1 Resistors ‹

› 701.3.2.2 Capacitors

Electrical Coils › 701.3.2.3

**WBS Dictionary**

**Code of accounts number:**

**Code of accounts number: 701**

**Description of the WBS element:**

**WBS elements are divided into three main parts:**

1. Hardware
2. Software
3. Electrical circuit

1- Hardware

**where it is divided into:**

A- Drone Hardware

- It includes the external and internal structure of the drone and its internal components.

B- Remote control Hardware

- Including the controller body.

2- Software

**where it is divided into:**

A- Drone Software

- It includes the Microcontroller and the operating code for the drone

B- Remote control Software

- It includes the Microcontroller and the operating code of the controller.

3- Electrical circuit

**where it is divided into:**

A- Drone

- It includes the internal components of the drone circuit.

B- Remote control

It includes the internal components of the control circuit elements.

**Person, or other organization responsible for the WBS element:**

**The other responsible for the WBS element is The National Company for the Reclamation and Cultivation of Desert Lands.**

**Resources required to create the WBS element (resources are people, materials, and facilities):**

**1- People: -**

|  |  |
| --- | --- |
| Mechanical Engineers | To create the mechanical design of the Drone. |
| Electrical Engineers | Drone circuit design. |
| Software Engineers | Drone programming. |
| Application Developer | Create the application. |

**2- Materials: -**

|  |  |
| --- | --- |
| Mechanical Part | Materials for the outer structure such as aluminum or plastic. |
| Electrical Part | Electronic parts such as resistors, capacitors, controller and driver  and motors. |

**3- Facilities: -**

|  |  |
| --- | --- |
| labs | Electrical and mechanical laboratories. |
| Machines | CNC machine and 3D Printer. |

**Cost to create the WBS element:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Hardware | | | | | |
| Remote control Hardware | | **Drone Hardware** | | | |
| Cost | External structure of the controller. | **Cost** | **External Hardware** | **Cost** | **Internal Hardware** |
| 5$ | 5$ | Drone propellers | 5$ | Motors |
| 5$ | Drone wings | 3$ | The Drivers |
| 5$ | The rest of the exoskeleton | 2$ | Sensors |
| Total | | **30$** | | | |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Electrical circuit | | | | |
| Cost | **Drone** | | **Cost** | **Remote control** |
| 0.5$ | Resistors | | 0.5$ | Resistors |
| 1$ | Capacitors | | 1$ | Capacitors |
| 1$ | Electrical Coils | | 1$ | Electrical Coils |
| Total | | **5$** | | |

**Cost to create the WBS element: 35$**

**Criteria for acceptance of the specific deliverable:**

1- It shall conform to the specifications and provide the services and features mentioned above.

2- It must be highly efficient, with an efficiency rate of up to 95%.

3- To be safe and easy to use.

**Milestone schedule:**

|  |  |
| --- | --- |
| Task Name | Duration |
| Preparing the mechanical design of the drone. | 20 days |
| Drone circuit design. | 15 days |
| Preparing the code for the drone. | 7 days |
| exoskeleton industry. | 14 days |
| print electrical circuit  (PCB) | 7 days |
| Drone control industry. | 10 days |
| Total | 73 days |

**Responsibilities matrix**

**The legend for this matrix:**

**A** = Approves

**R** = Reviews

**P** = Participant

**C** = Creator

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Mine Expert | Application Developer | Software Engineer | Electrical Engineer | Mechanical Engineer | Project Manager |  |
| R | **P** | **P** | **P** | **C** | **A** | **Drone Structure Industry** |
| P | **P** | **P** | **C** | **P** | **A** | **Electrical Circuit Design** |
| R | **P** | **C** | **C** | **C** | **P** | **Controller Industry** |
| R | **R** | **C** | **C** | **P** | **A** | **Drone Programming** |
| P | **C** | **P** | **P** |  |  | **Create the Application** |
| P | **C** | **P** | **P** | **P** | **A** | **Test the Application** |

**Project Network**

|  |  |  |
| --- | --- | --- |
| 28 | I | 25 |
| Micro  Remote | | **4** |
| 32 | **3** | **29** |

|  |  |  |
| --- | --- | --- |
| 15 | B | 10 |
| R.C.H | | **0** |
| 15 | **5** | **10** |

|  |  |  |
| --- | --- | --- |
| 25 | E | 15 |
| R.C.C | | **0** |
| 25 | **10** | **15** |

|  |  |  |
| --- | --- | --- |
| 35 | M | 32 |
| C.S | | **0** |
| 35 | **3** | **32** |

|  |  |  |
| --- | --- | --- |
| 32 | J | 25 |
| Code  Remote | | **0** |
| 32 | **7** | **25** |

|  |  |  |
| --- | --- | --- |
|  |  |  |
|  | |  |
|  |  |  |

|  |  |  |
| --- | --- | --- |
| 20 | C | 10 |
| I.H | | **0** |
| 20 | **10** | **10** |

|  |  |  |
| --- | --- | --- |
| 10 | A | 0 |
| E.H | | **0** |
| 10 | **10** | **0** |

|  |  |  |
| --- | --- | --- |
| 25 | F | 20 |
| Hard  Ware | | **0** |
| 25 | **5** | **20** |

|  |  |  |
| --- | --- | --- |
| 30 | K | 25 |
| E.C | | **0** |
| 30 | **5** | **25** |

|  |  |  |
| --- | --- | --- |
| 20 | D | 10 |
| Drone  Circuit | | **5** |
| 25 | **10** | **15** |

|  |  |  |
| --- | --- | --- |
| 23 | G | 20 |
| Micro  Drone | | **9** |
| 32 | **3** | **29** |

|  |  |  |
| --- | --- | --- |
| 40 | N | 35 |
| Soft  Ware | | **0** |
| 40 | **5** | **35** |

|  |  |  |
| --- | --- | --- |
| 30 | L | 27 |
| Drone  Soft | | **5** |
| 35 | **3** | **32** |

|  |  |  |
| --- | --- | --- |
| 27 | H | 20 |
| Code  Drone | | **5** |
| 32 | **7** | **25** |

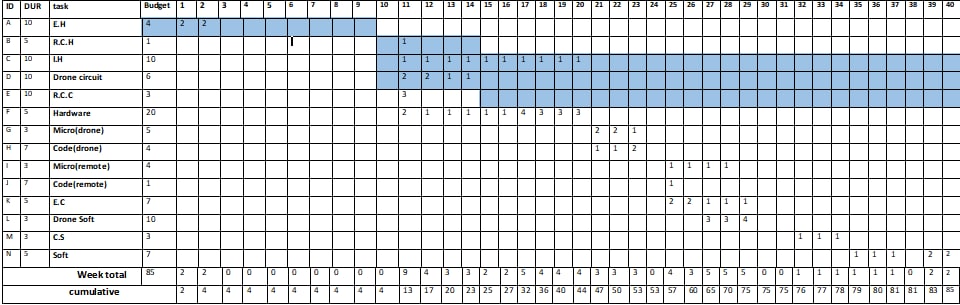
|  |  |  |  |
| --- | --- | --- | --- |
| Activity  Time(weeks) | Preceding  Activity | Description | Activity |
| 10 | None | Exoskeleton  Hardware  (E.H) | **A** |
| 5 | A | Remote  Control  Hardware  (R.C.H) | **B** |
| 10 | A | Internal  Hardware  (I.H) | **C** |
| 10 | A | Drone  Circuit | **D** |
| 10 | B | Remote  Control  Circuit  (R.C.C) | **E** |
| 5 | B, C | Hardware | **F** |
| 3 | D | Micro (Drone) | **G** |
| 7 | D | Code  (Drone) | **H** |
| 3 | E | Micro  (Remote) | **I** |
| 7 | E | Code  (Remote) | **J** |
| 5 | E, D | Electrical  Circuit  (E.C) | **K** |
| 3 | G, H | Drone  Software | **L** |
| 3 | I, J | Control  Software  (C.S) | **M** |
| 5 | L, M | Software | **N** |

**Resource Constrained**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID | RES | DUR | ES | LF | SL | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| A | **5P** | 10 | 0 | 10 | 0 | 5P | 5P | 5P | 5P | 5P | 5P | 5P | 5P | 5P | 5P |  |  |  |  |  |  |  |  |  |  |
| B | **3P** | 5 | 10 | 15 | 0 |  |  |  |  |  |  |  |  |  |  | 3P | 3P | 3P | 3P | 3P |  |  |  |  |  |
| C | **5P** | 10 | 10 | 20 | 0 |  |  |  |  |  |  |  |  |  |  | 5P | 5P | 5P | 5P | 5P | 5P | 5P | 5P | 5P | 5P |
| D | **5P** | 10 | 10 | 25 | 5 |  |  |  |  |  |  |  |  |  |  | X | X | X | X | X | 5P | 5P | 5P | 5P | 5P |
| E | **5P** | 10 | 15 | 25 | 0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | X | X | X | X | X |
| F | **3P** | 5 | 20 | 25 | 0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| G | **2P** | 3 | 20 | 32 | 9 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| H | **4P** | 7 | 20 | 32 | 5 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| I | **2P** | 3 | 25 | 32 | 4 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| J | **4P** | 7 | 25 | 32 | 0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| K | **3P** | 5 | 25 | 30 | 0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| L | **2P** | 3 | 27 | 35 | 5 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| M | **2P** | 3 | 32 | 35 | 0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| N | **3P** | 5 | 35 | 40 | 0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Total Resource Load | | | | | | 5P | 5P | 5P | 5P | 5P | 5P | 5P | 5P | 5P | 5P | 9P | 9P | 9P | 9P | 9P | 9P | 9P | 9P | 9P | 9P |
| Resource Available | | | | | | **12P** | **12P** | **12P** | **12P** | **12P** | **12P** | **12P** | **12P** | **12P** | **12P** | **12P** | **12P** | **12P** | **12P** | **12P** | **12P** | **12P** | **12P** | **12P** | **12P** |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ID | RES | DUR | ES | LF | SL | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
| A | **5P** | 10 | 0 | 10 | 0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| B | **3P** | 5 | 10 | 15 | 0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| C | **5P** | 10 | 10 | 20 | 0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| D | **5P** | 10 | 10 | 25 | 5 | 5P | 5P | 5P | 5P | 5P |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| E | **5P** | 10 | 15 | 25 | 0 | 5P | 5P | 5P | 5P | 5P | 5P | 5P | 5P | 5P | 5P |  |  |  |  |  |  |  |  |  |  |
| F | **3P** | 5 | 20 | 25 | 0 | X | X | X | X | X | 3P | 3P | 3P | 3P | 3P |  |  |  |  |  |  |  |  |  |  |
| G | **2P** | 3 | 20 | 32 | 9 | 2P | 2P | 2P |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| H | **4P** | 7 | 20 | 32 | 5 | X | X | X | X | X | 4P | 4P | 4P | 4P | 4P | 4P | 4P |  |  |  |  |  |  |  |  |
| I | **2P** | 3 | 25 | 32 | 4 |  |  |  |  |  | X | X | X | X | X | 2P | 2P | 2P |  |  |  |  |  |  |  |
| J | **4P** | 7 | 25 | 32 | 0 |  |  |  |  |  | X | X | X | X | X | 4P | 4P | 4P | 4P | 4P | 4P | 4P |  |  |  |
| K | **3P** | 5 | 25 | 30 | 0 |  |  |  |  |  | X | X | X | X | X | X | X | 3P | 3P | 3P | 3P | 3P |  |  |  |
| L | **2P** | 3 | 27 | 35 | 5 |  |  |  |  |  |  |  | X | X | X | X | X | 2P | 2P | 2P |  |  |  |  |  |
| M | **2P** | 3 | 32 | 35 | 0 |  |  |  |  |  |  |  |  |  |  |  |  | X | 2P | 2P | 2P |  |  |  |  |
| N | **3P** | 5 | 35 | 40 | 0 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 3P | 3P | 3P | 3P | 3P |
| Total Resource Load | | | | | | 12P | 12P | 12P | 10P | 10P | 12P | 12P | 12P | 12P | 12P | 10P | 10P | 11P | 11P | 11P | 12P | 10P | 3P | 3P | 3P |
| Resource Available | | | | | | **12P** | **12P** | **12P** | **12P** | **12P** | **12P** | **12P** | **12P** | **12P** | **12P** | **12P** | **12P** | **12P** | **12P** | **12P** | **12P** | **12P** | **12P** | **12P** | **12P** |

**Budget Baseline**



**Risk Management**

**The risks that can face our project: -**

1- Incompatibility of the electronic chip used with the circuit.

2- Delayed sensor response.

3- The code is not compatible with the chip.

4- Loss of control of the drone.

5-There is a fear of mines exploding in the drones and thus it could cause some losses.

**Dealing with these risks: -**

1- Experimenting with electronic chips with the circuit more than once.

2- Try to use high quality sensors.

3- Test the code more than once with the electronic chip.

4- Experiment with the controller with the drone more than once and provide the drone with a safety device.

5- The use of strong materials in the manufacture of the external structure of the drone, and the drone has the ability to detect mines over large areas.

**Project Monitoring: -**

**The project is monitored by:**

1- Holding permanent meetings with the work team to monitor the latest developments.

2- Overseeing everything on the project.

3- Each member of the team must submit a detailed report on what he has achieved and his mission.

**Level number:** level two

**Group number:** group one (1)

**Session number:** session three (3)

**Team names:**

**1-** Islam Abdelhady Hassanein **(The leader)**.

**2-** Awab Khaled Abdallah Mohamed.

**3-** Islam Nasser Farrag Hassan.

**4-** Amir Mustafa Ibrahim Mohamed.

**5-** Ashrqt Helmy Farouk.

**6-** Asmaa Mohamed Bauomy.