

Redundant Communications for a Degraded Electromagnetic Environment

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Embedded Electronic Systems Design and Development BEng

1 Problem introduction:

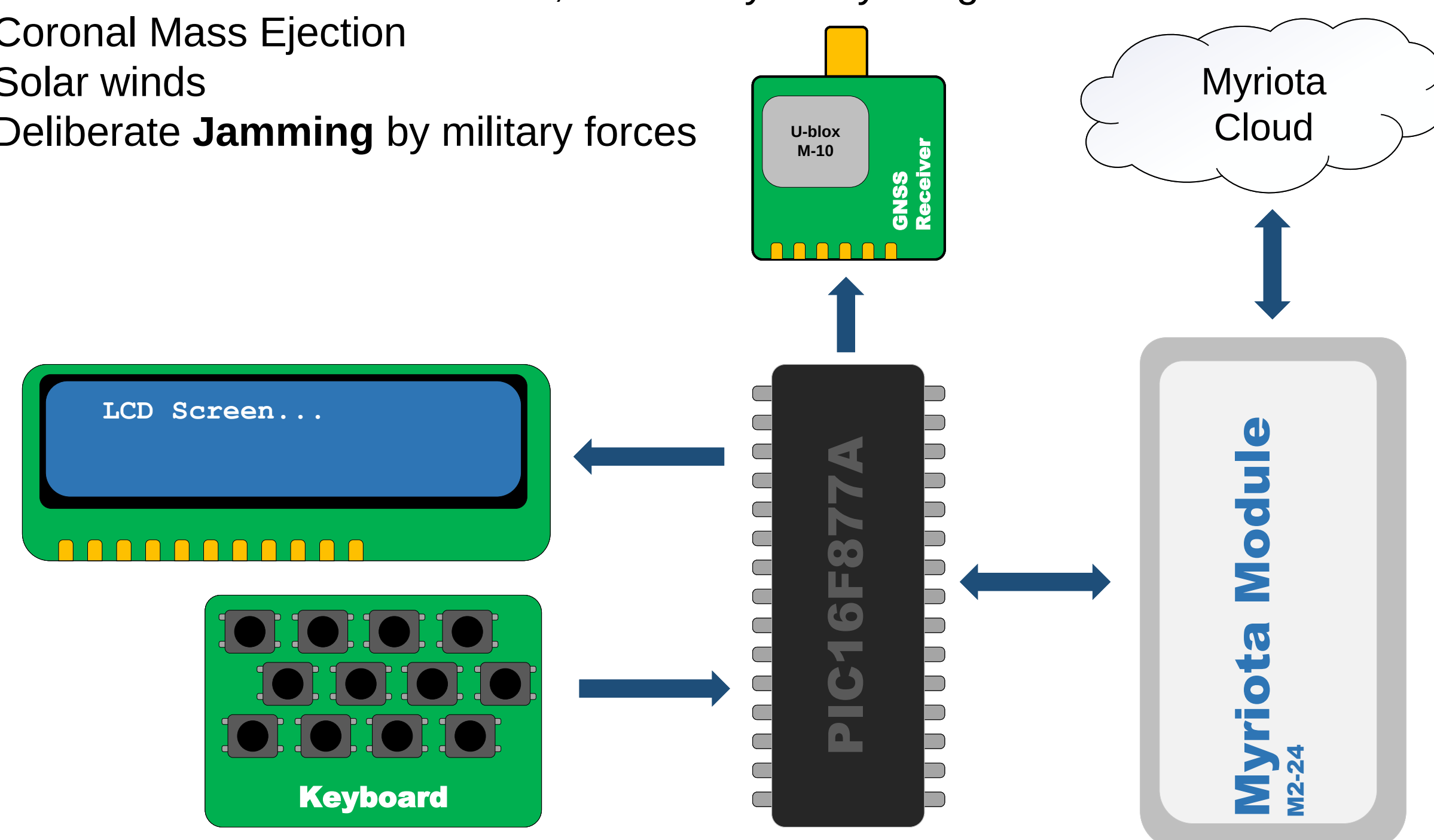
A **Degraded Electromagnetic environment** (DEE) can be defined as: “An environment with an abnormally large amount of background **electromagnetic radiation**, reducing the performance or function of electronic devices”

DEEs represent a particularly difficult problem to solve and can affect both military and civilian systems.

- **GNSS** signal disruption affects **navigation** for road vehicles, ships, and aircraft.
- Disrupted communications makes it difficult to share the existence or impact of a problem, or technical details required to fix it.
- Artificial **DEEs** may be created by authoritarian regimes to suppress communication with the free world, reducing awareness of issues, and preventing political change.

DEEs Can be natural or artificial, caused by many things such as:

- Coronal Mass Ejection
- Solar winds
- Deliberate **Jamming** by military forces



5. Hardware overview

The system employs a **distributed intelligence** approach between two components:

PIC Microcontroller:

- Responds to button presses.
- Prints to the LCD screen.
- Receives the location from the **GNSS** board.
- Structures messages to be transmitted.

The Myriota device:

- receives the message from the PIC chip, and encodes, modulates, and transmits it the message to the **Myriota cloud**.

6. Software overview:

Software for the system can be grouped into three main areas:

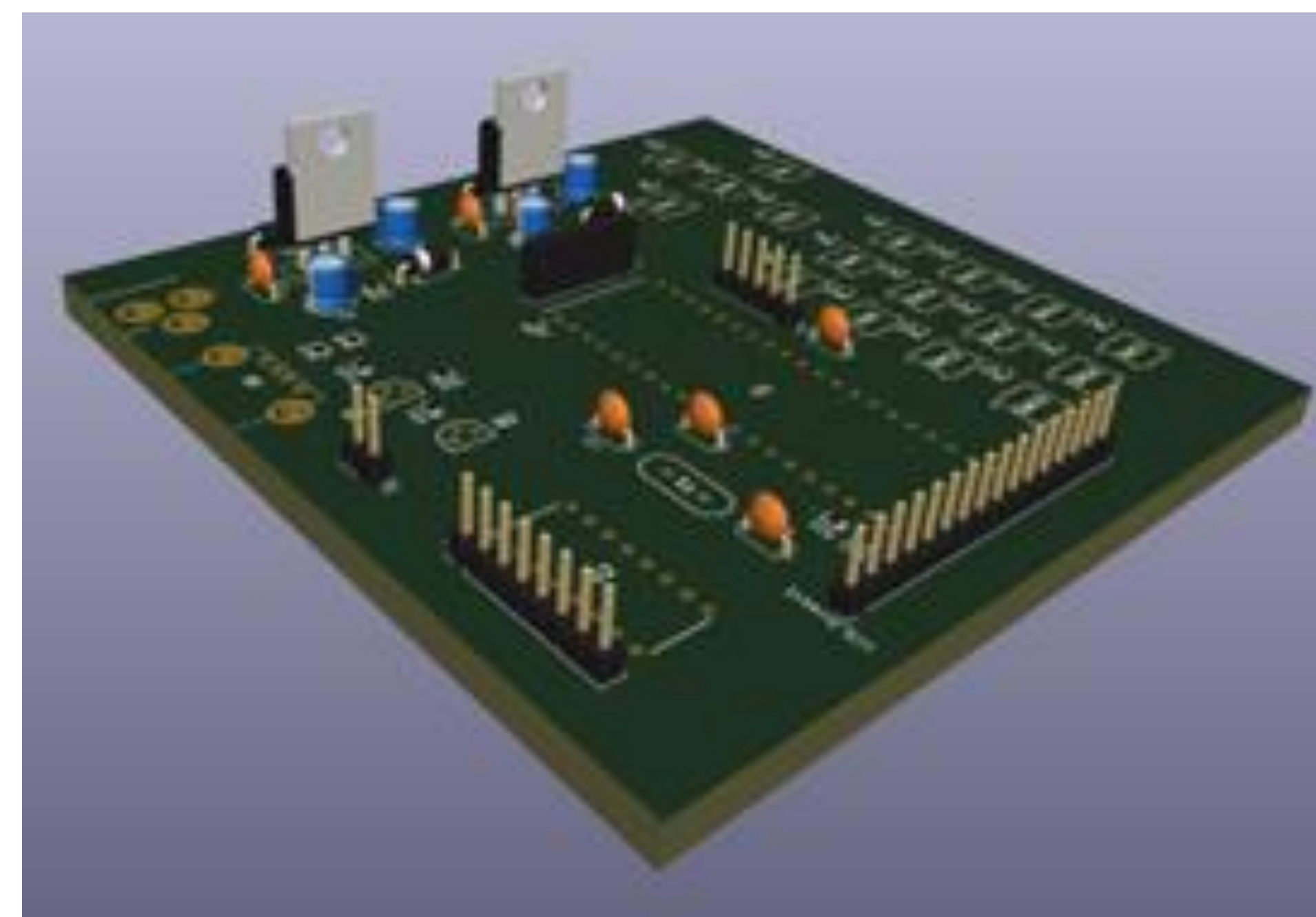
- **User Interface:** each different screen has its own function, waiting for the user to press a key with the `await_input` function, updating the LCD screen as appropriate.
- **Receiving Location:** The PIC listens to the GNSS board through UART and processes the longitude and latitude from the \$GNGLL sentence.
- **UART communication:** The communication between the PIC and Myriota module is achieved via UART at 9600 baud.

2 Project objectives:

- Establish a reliable communications link to the **Myriota cloud**.
- Design all hardware to be appropriate for man-carried operation.
- Test and validate successful message delivery to **Myriota cloud**.

3 Project management:

A hybrid development approach was selected for this project, employing characteristics from the **waterfall** and **spiral** development methodologies, allowing a linear progression from idea, to design, to finished solution while also quickly de-risking some of the more difficult aspects of the project.



4. Proposed solution: Myriota Network Connectivity

Myriota are an Australian company offering space as a service, selling modules and subscriptions that connect to their constellation of **satellites**. The **Myriota network** is designed around reducing power consumption and cost as much as possible. They typically find their products used in remote sensing applications.

Of all the providers offering *space as a service*, **Myriota** offer the most attractive solution for a man-carried product. This is due to the small size and low power requirements of their module, and lower transmission frequency than most **satellite communications**.

8. Project Completion

Due to the condensed timeline of this project, further development is required for a finished solution:

- **PCB** manufacture and test
- Case and environmental assurance
- **UART** sentence communication between the **PIC** and **Myriota module**.

7. Personal impact

Completing this project has been really interesting for me and has been such a fantastic opportunity to develop my skills as an engineer. Although the project isn't completed, I know it's due to a lack of time, and not because any of the problems can't be figured out. As a result, I feel much more confident to take on more ambitious technical projects in the future, albeit fitting them into a more conservative timeline.

