



arm

Lesson 7

Ciphers, LCD and GPS



arm School Program

Radio communication

- Mobile devices need to communicate with other devices
- If you use a smartphone to connect to the internet you use **radio waves** to do this
- The strength of the signal varies as you move further away from the **transmitter**
- **Physical objects** which get in the way also reduce the signal strength
- As the signal strength gets weaker the speed of the data transfer slows



Security

- As information is being transmitted through the air, other people could **intercept** it
- It is important that this information is kept secure so that if someone were to intercept it, they wouldn't be able to understand it
- To make sure the information is hidden this data is scrambled



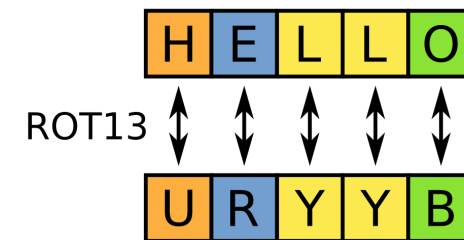
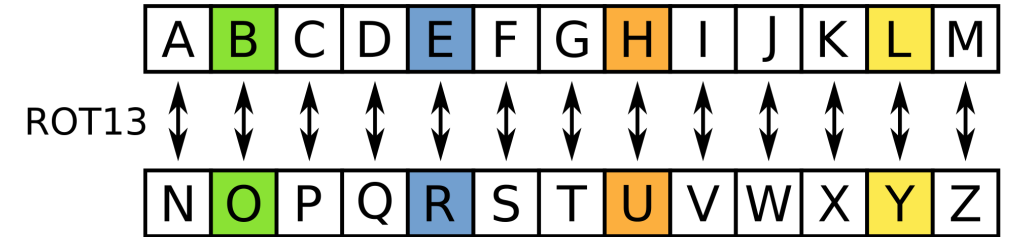
Encryption

- The process of encoding data is known as **encryption**
- To encrypt data, we apply a special algorithm called a **cipher**
- The cipher is applied to the plain message so that it is scrambled



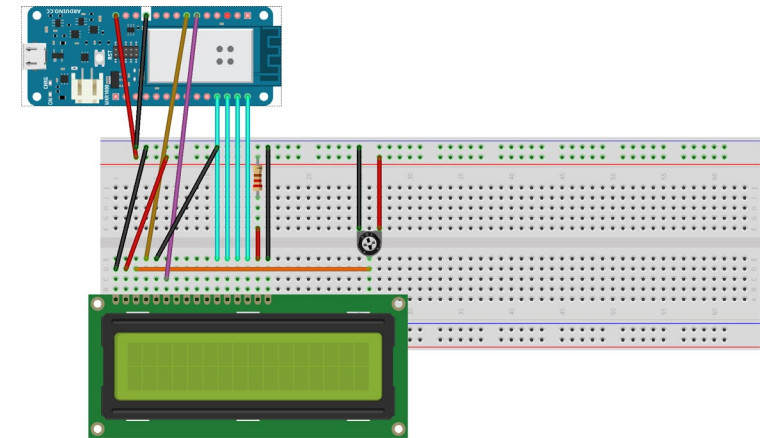
Caesar Cipher

- One of the oldest encryption ciphers is called the 'Caesar Cipher'. Julius Caesar used the cipher when sending messages
- The cipher shifts each letter in the message by a specific number of characters to encrypt it
- If the shift was +3 the word 'HELLO' would be encrypted to 'URYYB'
- Try to work through the Cipher worksheet to see if you can crack the secret message, and also come up with some of your own



Connecting the LCD and GPS to the Arduino

- Are are going to create the circuit and then test the two individual elements
- Connect the MKR Arduino to the carrier by inserting the pins into the board
- Connect the MKR GPS Shield to the Arduino using the cable provided
- You are now ready to connect the breadboard using the circuit diagram



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Testing your GPS and LCD screen

- Upload the sample LCD file to your Arduino
- If the circuit has been wired up correctly, it will display 'hello, world!' on the screen

```
standby
delay .....
wakeup
wait location ... 3514 ms

Location: 51.3175278, -2.1794775
Altitude: 85.30m
Number of satellites: 7

standby
delay .....
wakeup
wait location ... 3885 ms

Location: 51.3176193, -2.1796472
Altitude: 22.20m
Number of satellites: 6

standby
delay .....
wakeup
wait location ... 4911 ms

Location: 51.3174553, -2.1793211
Altitude: 82.00m
Number of satellites: 6

standby
delay .....
```



- Upload the sample GPS file to your Arduino. If it is working you should see the GPS coordinates displayed on the serial monitor

Challenge – treasure hunt

- Write a secret message for one of your friends using a cipher of your own choice
- Hide the message and record the GPS coordinates of where you have hidden it
- Tell your friend the GPS coordinates of where the message is located. They should then use their GPS device to find the message and try to crack the code



Thank You

Danke

Merci

谢谢

ありがとう

Gracias

Kiitos

감사합니다

धन्यवाद

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