# ME-304 Project Report

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## Title: Mini drone solution for landmine detection

**Problem statement:**

Develop a mini drone equipped with metal detection technology to remotely detect and pinpoint the locations of landmines. The drone should record and transmit GPS coordinates of detected landmines for prompt action, while also incorporating GPS tracking for remote control and retrieval in case of malfunction or signal loss. This initiative aims to reduce the risks faced by military personnel and civilians during landmine detection and recovery operations, thereby enhancing overall safety and operational efficiency in military settings.

**Approach:**

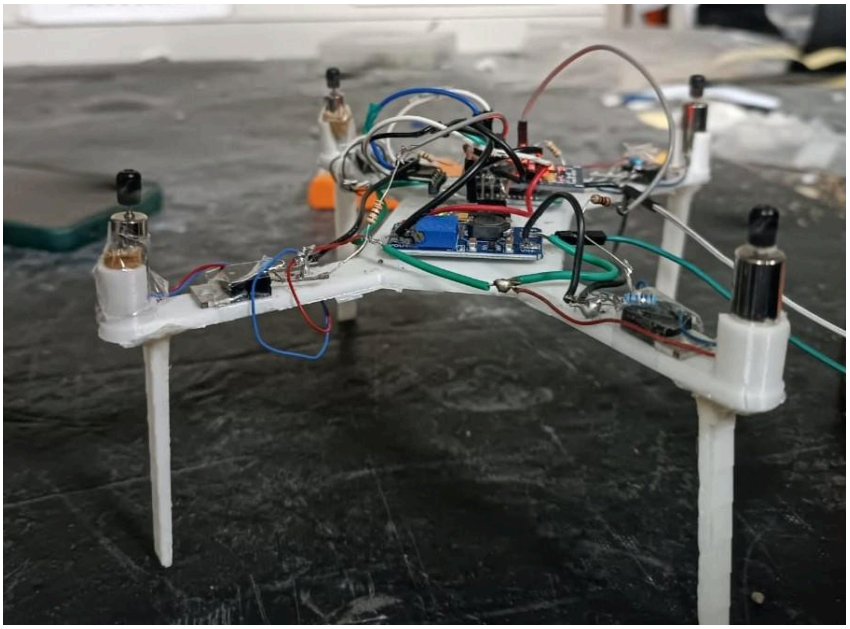
We divided our project into 3 parts, and our idea was to combine all the 3 parts and combine to give us the ultimate solution.

**Inventory:**

Arduino pro mini - 299/-
MPU6050 - 210/-
Hc-05 Bluetooth module - 227/-
Mt3608 dc to dc boost converter - 49/-
8520 micro coreless motors - 260/-(4)
Irfz44N channel mosfet - 80/-(4)
10k ohm resistor - 49/-
1k ohm resistor - 59/-
1s battery - 134/-
USB to serial convertor - 123/-
2-cw, 2-ccw propellers - 60/-
Jumper wires - 50/-
3D printing - 70/-
**Total - 1650/-**

**Process:**

**Step 1: Basic Mini Drone**



First part was to make a basic drone.
We used arduino pro mini, bluetooth module, MPU6050, booster module,

Arduino pro mini is a microcontroller, the Arduino Pro Mini can be easily integrated into the drone's electronics system, allowing it to control various components such as motors, sensors, and communication modules. Its compatibility with a wide range of sensors and peripherals makes it versatile for different drone functionalities.

A booster module in a mini drone project amplifies signal strength, extending communication range and improving signal quality. This results in more reliable control, smoother flight, and increased safety. It also enhances versatility for various applications like photography and surveillance. Booster module is used to increase the potential from 3.7V to 5V.

Bluetooth allows for wireless communication between the drone and external devices such as smartphones. This enables users to control the drone remotely without the need for physical connections. With a Bluetooth-enabled controller app on a mobile device(remote xy), users can remotely control the drone's movement, direction, and other functionalities.

We have used HC-05 bluetooth module, the range of HC-05 bluetooth module is around 30 metres.

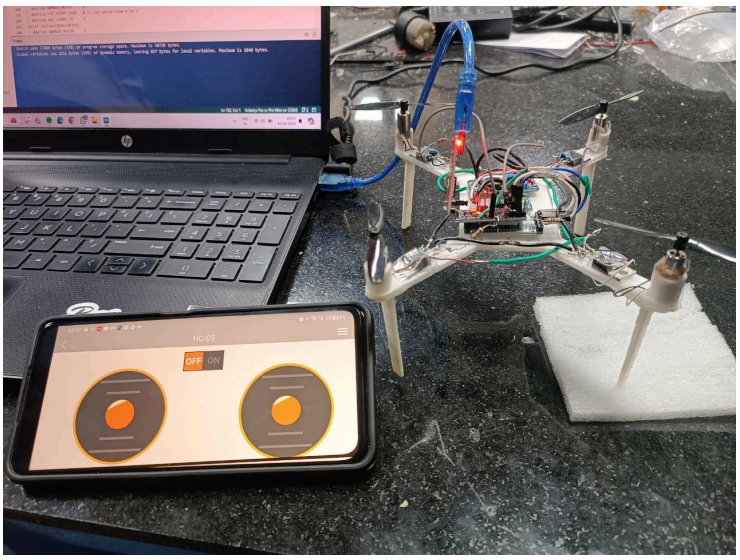
The MPU6050 sensor module is essential in mini drone projects for its Measures acceleration and rotation for stability. Adjusts motor speeds for stable flight. Identifies flight modes for different maneuvers. Helps maintain consistent altitude. Assists in positioning and maintaining flight path. Enables intuitive drone operation. Supports prototyping and experimentation.

The mini drone project utilizes a rechargeable LiPo battery for its power source, chosen for its rechargeability and appropriate voltage output. The battery's output is directed to a booster module, tasked with amplifying the voltage to suitable levels. The boosted voltage is then connected to an Arduino Pro Mini microcontroller unit, which serves as the central processing unit for the drone's operations. Concurrently, an MPU6050 sensor module is interfaced with the Arduino Pro Mini to gather data on acceleration and stability.

To regulate motor function effectively, MOSFETs are employed as switches between the motors and electrical wires, allowing precise control over motor operation. We have used IRFZ44N Mosfet.
In this Mosfet,
The maximum drain source voltage |Vds|: 55V
The maximum gate-source voltage |Vgs|: 20V
The maximum gate-threshold voltage |Vgs(th)|: 4V

The Arduino Pro Mini is programmed with MultiWii software, facilitating the integration of sensor data and control algorithms. This software governs the PID values, critical for stabilizing the drone during flight, and manages orientation and angle data obtained from the MPU6050 sensor.

External control of the drone is achieved through the Remote XY mobile application, which establishes a Bluetooth connection with the drone. The Remote XY app interface includes two joysticks, providing control over throttle, pitch, and yaw movements. Through this interface, users can dictate the drone's motion with precision.

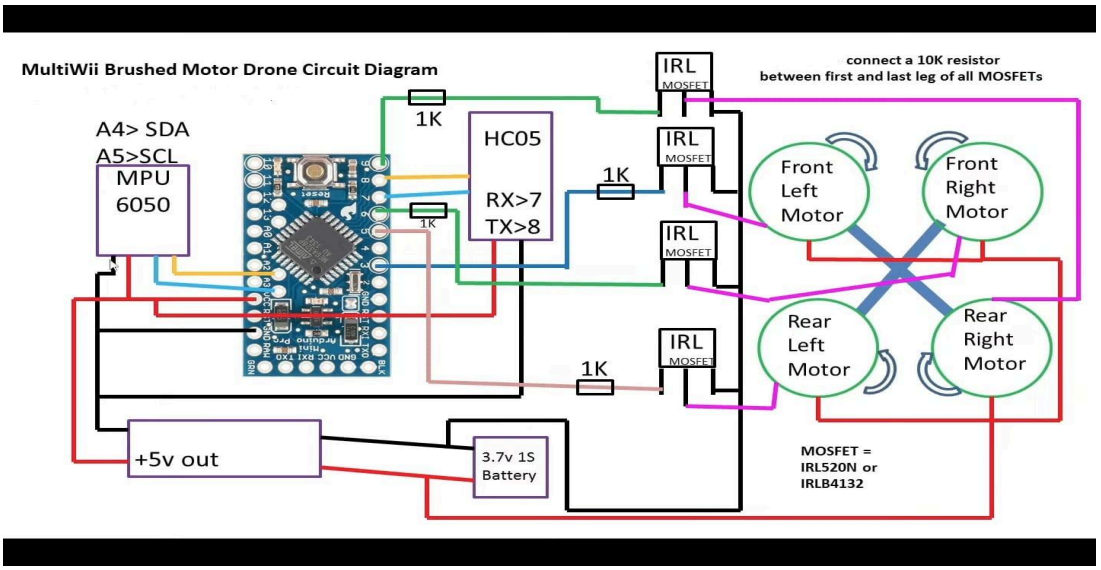


To ensure seamless communication between components, a 1k ohm resistor is incorporated between the Arduino Pro Mini and MPU6050 sensor. This setup ensures optimal signal transmission and reception between the components, enabling accurate control and stability.

The LiPo battery, serving as the drone's power source, is securely attached to the underside of the drone for optimal weight distribution and balance. Through the MPU6050 sensor, the drone continuously monitors its acceleration and stability, transmitting relevant data to the Arduino Pro Mini for real-time adjustments and flight control.

The Arduino Pro Mini governs the operation of the drone's motors, which in turn control the rotation of the drone's blades, enabling flight.

**Circuit Design:**

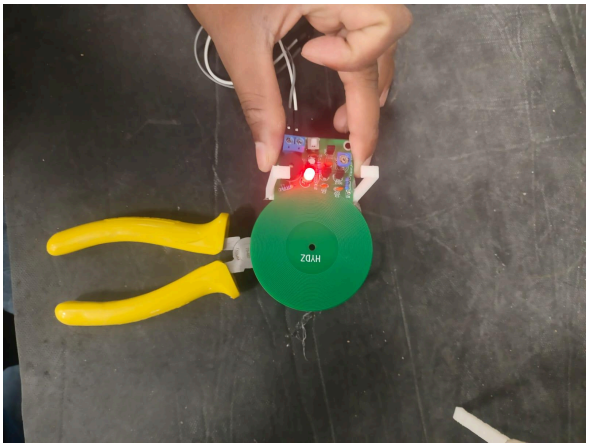


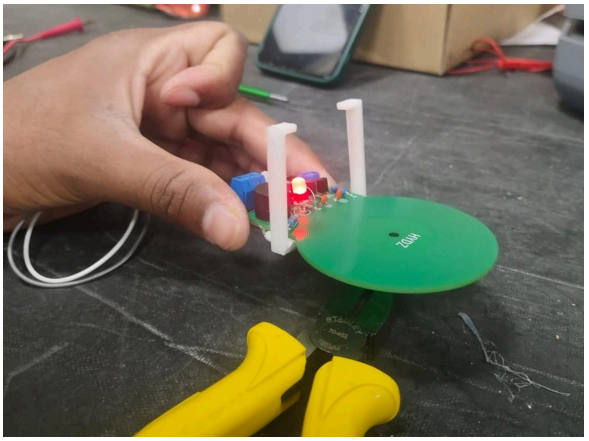
**Step 2: Metal Detection**

We have made a circuit using coil, three resistors (200k ohm, 2k ohm, 470 ohm) , five capacitors (222 nF(2), 100nF(2), 100uF), three transistors ( 9012 (2), 9018), potentiometer, switch, buzzer.

Whenever a metal is detected under the coil, there will be a change in inductance of the coil which activates the buzzer, an extra LED is also connected parallel to the buzzer which indicates the metal detection.

In order to decrease the weight of the metal detection circuit, we came up with another alternative of preparing a metal detection circuit using IC555, capacitors, resistors, copper coil and buzzer.  When the battery is connected, the buzzer emits a continuous sound, and there's a slight variation in its amplitude when the coil detects metal. Despite several attempts to amplify this effect such as adjusting the coil's turns and trying various capacitor and resistor combinations achieving a noticeable change in the buzzer's amplitude upon metal detection has proven challenging





**Attaching the metal detection part with the drone:**

The power supply of the mini drone also serves as the power source for the attached metal detector. Positioned beneath the mini drone, the metal detection component is activated when the drone approaches a metallic object. Upon detection, the buzzer integrated into the metal detector emits a sound signal, alerting users to the presence of metal nearby. This integration maximises the drone's functionality, allowing for simultaneous metal detection capabilities alongside its primary flight functions.

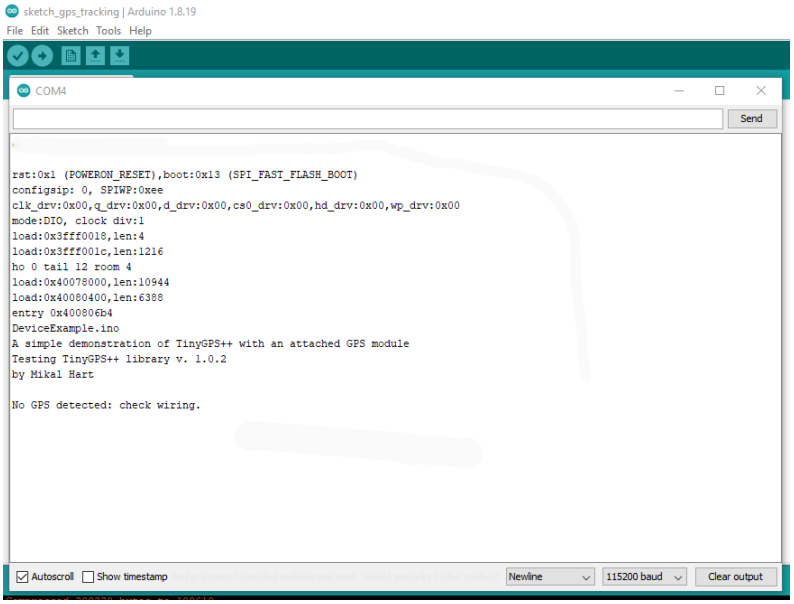
Initially, we planned to use 1020 coreless motors for our drone project.

However, due to their unavailability in the market, we opted for the next most powerful option, the 8520 coreless motors. During testing, we encountered issues with two of the 8520 motors, leading us to switch to 720 coreless motors. Unfortunately, the downgrade in motor power resulted in a reduced lifting capacity of only up to 50 grams, insufficient for our drone's weight of 85 grams, including the metal detection component. As a result, our motors were unable to lift the drone.
Thrust per motor of 720 coreless motor: 15 gm
Thrust per motor of 8520 coreless motor: 30 gm
Thrust per motor of 1020 coreless motor: 45 gm

**Challenges faced in implementing GPS Tracking:**

In our project, we tried to incorporate GPS tracking functionality utilising the TinyGPSPlus library, specifically designed for Arduino environments to streamline the extraction of location data from GPS modules. This library adeptly parses NMEA data streams, furnishing essential parameters such as latitude, longitude, altitude, speed, and time, thereby simplifying the integration of GPS capabilities into diverse projects. Our Arduino code was meticulously crafted leveraging the features offered by the TinyGPSPlus library.

To execute our implementation, we utilised the ESP-32s microcontroller for uploading the code and paired it with the NEO-6M GPS Module. Despite successful code upload, we encountered an obstacle as the system consistently displayed the message 'No GPS Detected.' Regrettably, our troubleshooting efforts were inconclusive, and we were unable to resolve the issue.



**Conclusion:**

Our project aimed to develop a mini drone equipped with metal detection technology and GPS tracking to enhance safety and efficiency in landmine detection operations. Despite encountering challenges, such as optimising the metal detection circuitry and resolving GPS connectivity issues, we remain committed to refining our solution. Through collaboration and continued innovation, we believe our mini drone solution has the potential to significantly improve landmine detection efforts, ultimately saving lives and mitigating risks. We are dedicated to further research and development, leveraging technology to address pressing security and humanitarian challenges.
Our drone could not fly because of insufficient thrust.

**Final Prototype:**