

ASSAM POLICE HACKATHON

PROJECT TITLE **SMART MOVEMENT** **TRACKER**

PROOF OF CONCEPT



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SOUNDAR S

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Introduction

In this 20th century, most of the persons and the agencies including government and private have own vehicles. Vehicle tracking is one of the first and foremost thing to do track vehicle belongings. In order to track a vehicle we have different kinds of ways but not all are efficient. By keep in mind that the device would be small in size, power efficient, high accuracy, less maintenance, reliable, user friendly. We focused on these things and designed an efficient device which has all the mentioned features, will help the enforcement agencies to track their vehicles and communicate with them.

Problem statement

To track the vehicle from point A to point B, in which if there is any deviation from its path, it alert or send the information about deviation along with its exact location to the corresponding law enforcement agency to track the vehicle, where actually it was.

Proposed idea

To satisfy this application, we use mobile to mobile communication (M2M) system. In this system we use a powerful system on chip module - MC60 that comes under embedded system to satisfy this requirement. By using this SOC module we would get a required product efficiently.

Technology used

Mobile to mobile communication

In the most basic form, a cell phone is essentially a two-way radio, consisting of a radio transmitter and a radio receiver. When you make a call with your friend on your cell phone, your phone converts your voice into an electrical signal, which is then transmitted via radio waves to the nearest cell tower. The network of cell towers then relays the radio wave to your friend's cell phone, which converts it to an electrical signal and then back to sound again. In the basic form, a cell phone works just like a walkie-talkie.

The Global System for Mobile Communications (GSM) is a standard developed by the European Telecommunications Standards Institute (ETSI) to describe the protocols for second-generation (2G) digital cellular networks used by mobile devices such as mobile phones and tablets. It was first deployed in Finland in December 1991. By the mid-2010s, it became a global standard for mobile communications achieving over 90% market share, and operating in over 193 countries and territories including India.



Fig1-GSM

The GSM standard originally described a digital, circuit-switched network optimized for full duplex voice telephony. This expanded over time to include data communications, first by circuit-switched transport,

then by packet data transport via General Packet Radio Service (GPRS), and Enhanced Data Rates for GSM Evolution (EDGE).

"GSM" is a trade mark owned by the GSM Association.

One of the key features of GSM is the Subscriber Identity Module, commonly known as a SIM card. The SIM is a detachable smart card containing the user's subscription information and phone book. This allows the user to retain his or her information after switching handsets.



Fig2-Sim card

Simply, mobile to mobile communication is a closed system in which a particular users are connected and communicated together on a time.

We made this technology for this specific application and designed our own product which gives the efficient results.

We fix one stable device, similar to mobile phone having SMS and call function, in the vehicle which carries a specific sim card along with the module used to send and receive data or user commands.

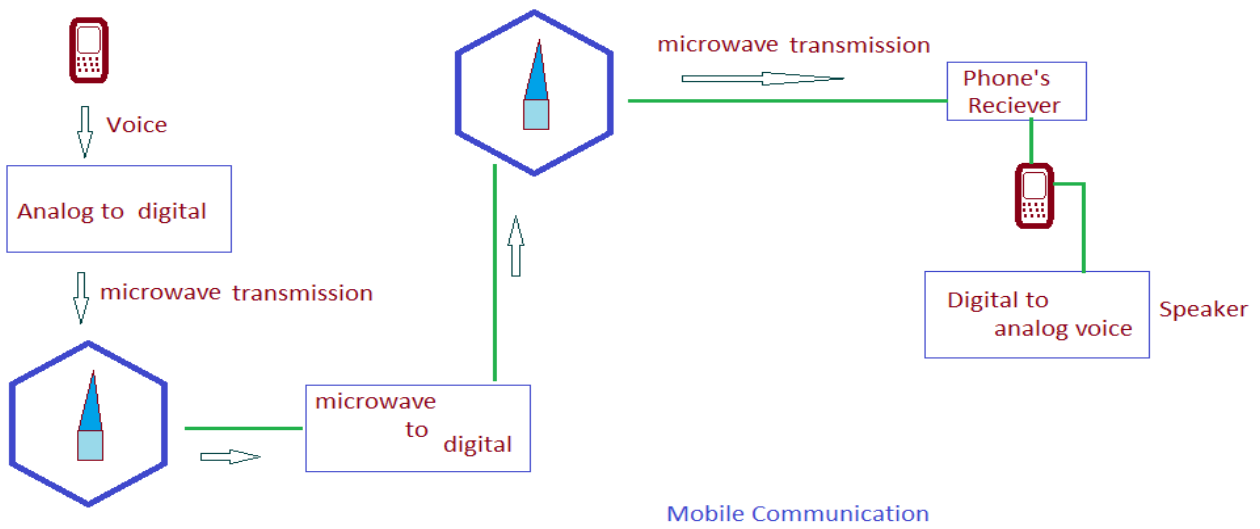


Fig3-GSM block diagram

Hardware design

For this application we use 2G IOT module called MC60, from quectel.

MC60 - 2G IOT module Overview



Fig4-MC60 module

- MC60 is a quad-band full-featured GSM/GPRS/GNSS module using LCC castellation package.
- With an extensive set of Internet protocols (TCP, UDP, PPP, FTP, HTTP, SSL, MQTT, etc.), it integrates the GNSS technology for satellite navigation.
- Based on the latest 2G chipset, it has the optimal performance in SMS & data transmission as well as audio service even in harsh environments.
- It features Dual SIM Single Standby function.
- MC60 module integrates both GPRS and GNSS engines in one compact and low profile SMT package.
- It supports EPO™ technology which provides predicted Extended Prediction Orbit to speed up TTFF without need of extra server.
- EASY™ (Embedded Assist System) technology is also supported.
- It enables the GNSS engine to achieve a very fast first fix when there is no enough satellite information.
- MC60 additionally supports working in proven Always Locate™ and GLP (GNSS Low Power) modes, which ensure great positioning accuracy while with ultra-low power consumption.
- The built-in LNA provides the module with improved RF sensitivity and exceptional acquisition/tracking performance even in weak signal areas.

Why MC60 module

The compact form factor, great positioning performance, low power consumption and dual (U)SIM card interfaces make MC60 the best choice for a wide range of M2M

applications, such as automotive, telematics, wearable device, asset tracker, pet tracker, and so on.

Key Benefits

- Ultra compact size: $18.7 \times 16.0 \times 2.1\text{mm}$
- Multi navigation constellation: GPS/ GLONASS/ Galileo/ BeiDou/ QZSS
- Support Voice, SMS, QuecFOTA, DSSS and QuecOpen
- GSM quad-band: 850/ 900/ 1800/ 1900MHz
- Built-in LNA for better GNSS sensitivity (-167dBm@Tracking): able to use passive GNSS antenna without the need of any extra LNA
- Powerful AGPS functions: Autonomous AGPS EASY™ / Offline AGPS EPO™ / Online AGPS QuecFastFix
- Multi internet protocols:
TCP/UDP/FTP/PPP/HTTP/NITZ/NTP/PING/HTTPS/TCP/SSL/MQTT

Software used for designing PCB board

- ❖ We designed the PCB board using
EAGLE software,
(EAGLE – Easily Applicable Graphical
Layout Editor).



Design model

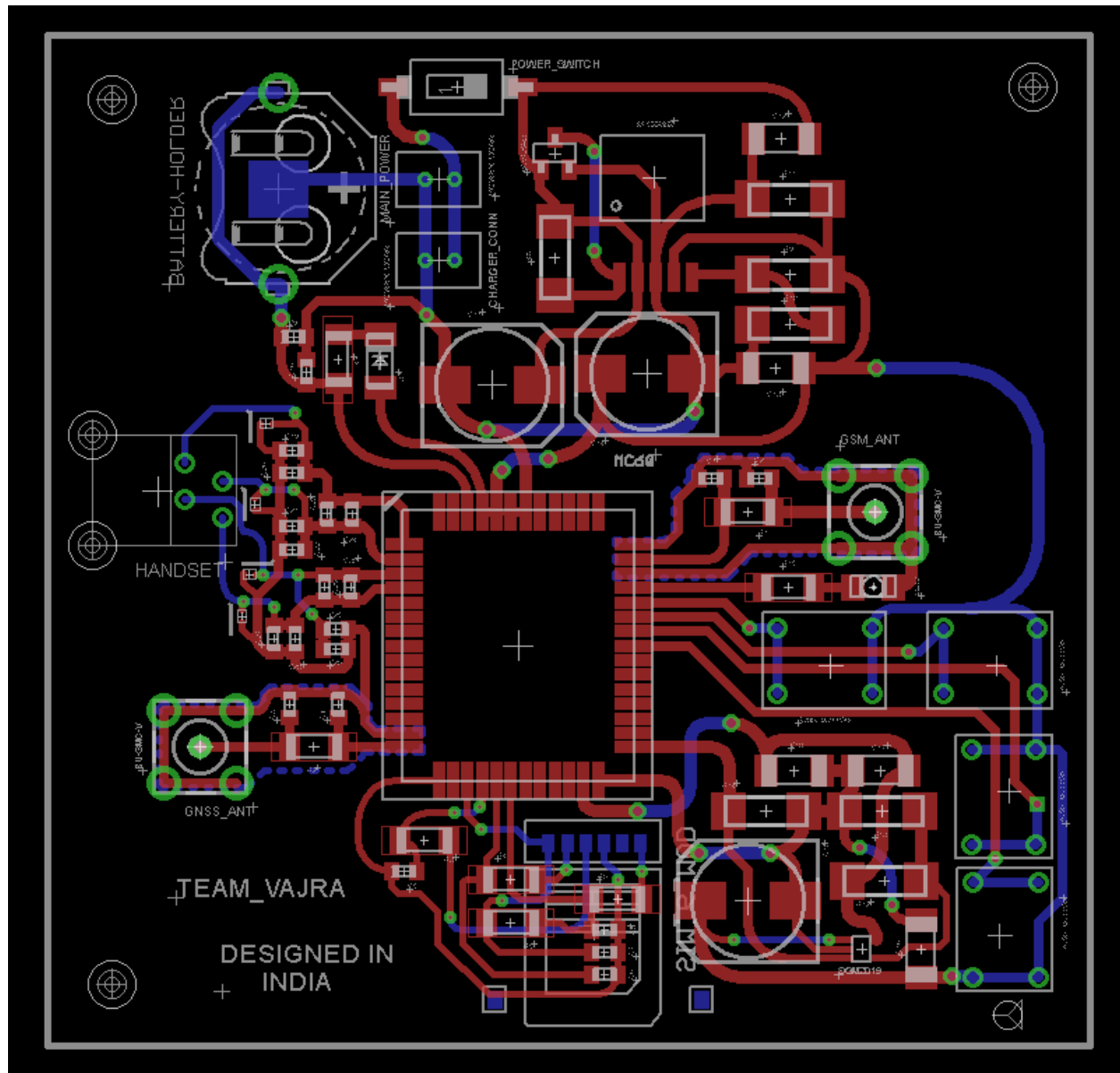


Fig5-PCB board image

3D view

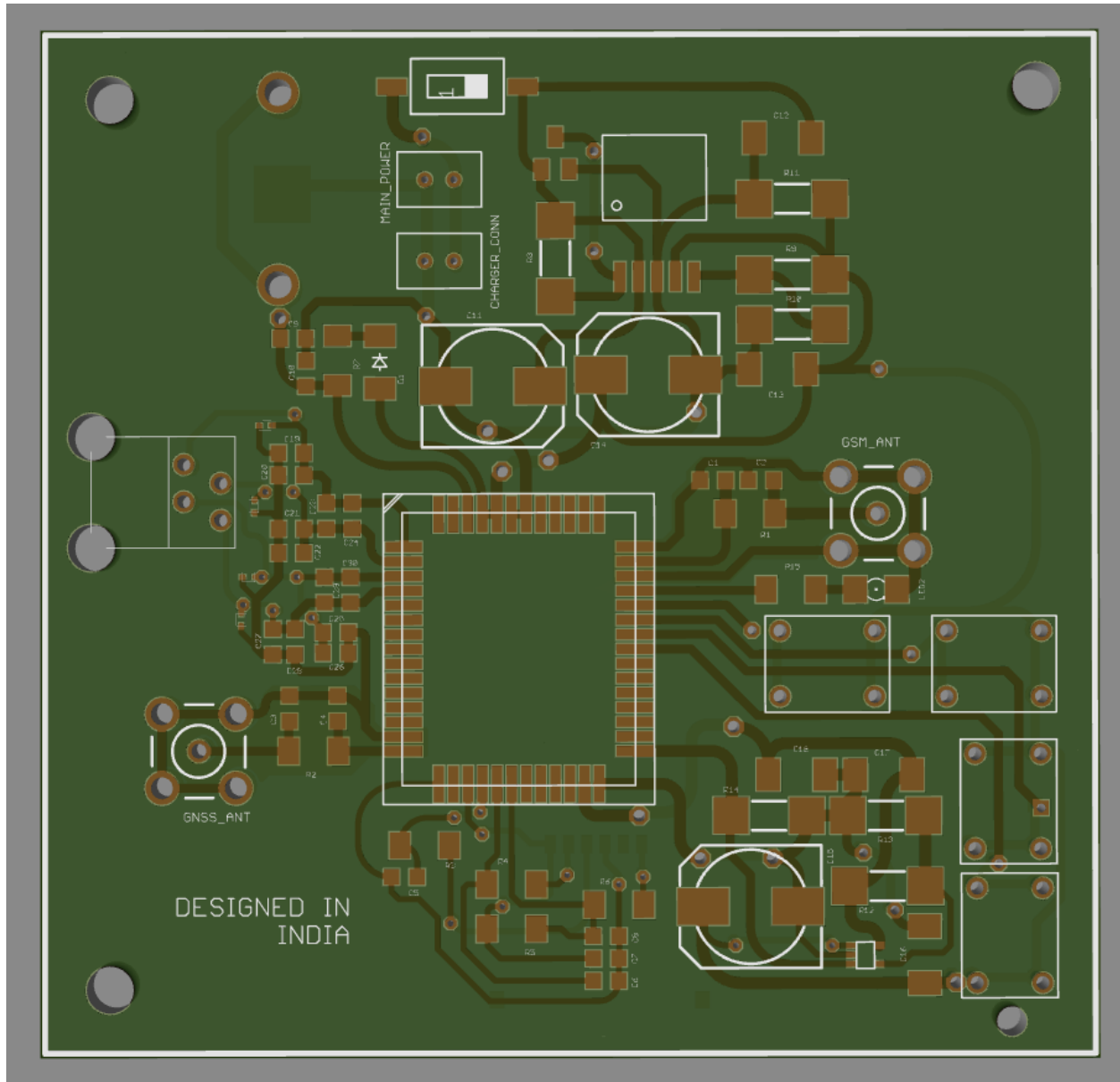


Fig6-PCB Top view

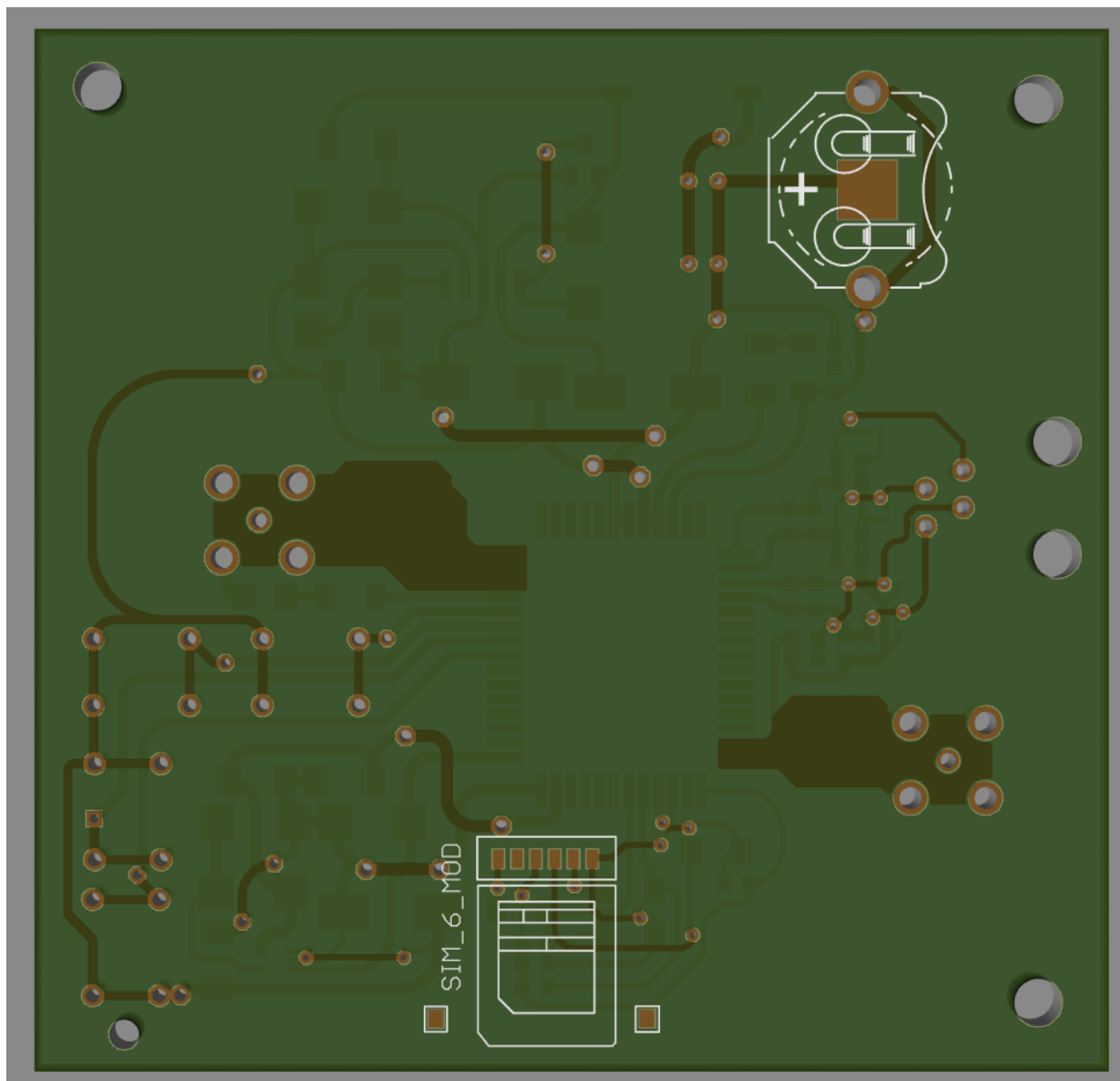


Fig7-PCB Bottom view

Real time use

We program the MC60 module for this application in the concept of comparing the values. The corresponding latitude and longitude details of the path was taken initially and set reference to the module. The module able to get its exact location and compare the values (latitude and longitude) with the reference locations and it sends an alert message of deviation to the law enforcement agency when a single reference value is not matched.

In this device we add a call function which helps the driver to communicate with the law enforcement agency in case of any emergency situation by just pressing a simple button to make and cut a call also pick up call from enforcement agency by just pressing a button.

Due to small in size and less power consumption we fix this device in the battery operated vehicles such that these battery vehicles are used in parks, etc. hence we satisfies the main condition that used in Kaziranga National Park, Assam.



Fig9-battery operated vehicles

Pros and cons

- Overall cost of the product is around ₹ 1800/- (Including GST)
i.e. cost efficient
 - For device operation it requires typically 4.00V / 1.7Amps
i.e. power efficient
 - Size of the product is 7Cm X 7Cm i.e. ultra compact in size
 - Less maintenance
 - User- friendly i.e. easy to use
 - If you fix this device in the vehicle, we may charge the battery of the device through the vehicle's battery.
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- For this application we need at least 500-1000 values of the location such as latitudes and longitudes (based on the path distance) and this values should be added in our main program.

Cost of the product

NAME	PRICE
MC60 module	₹500
Other components (including smd resistors, capacitors and other related components)	₹600
PCB fabrication (double layer)	₹500
Outer body of the product	₹200
Total	₹1800/-

Degree of completion

We analyse the problem statement and we found a relevant solution to it. We completed the main condition that smart movement tracking and also we implemented our product in hardware design that files also attached.

Conclusion

Due to small in size, power efficient, less maintenance, more reliable, low cost, we could fix the device in the battery operated vehicles. Hence we use this vehicles in the Kaziranga national park, Assam, for tourism and other relevant works.

Demo video link: <https://drive.google.com/file/d/1BhuPp5V5nZRGszjZBplytI4NZEd-tO9x/view?usp=sharing>



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