AN2697

Location Tagged SOS Using a Curiosity Development Board

Introduction

This application demonstrates the indication of a personal emergency, or communicates a distress signal by sending out a location tagged SOS through SMS.

The application is implemented on the PIC32MZ EF Curiosity Development Board. The PIC32MZ2048EFM100 microcontroller unit (MCU) interfaces to a GSM-GPS click board over the UART.

For more information on the features and layout of the PIC32MZ EF Curiosity Development Board, refer to the PIC32MZ EF Curiosity Development Board User's Guide (DS70005282).

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1. Required Tools and Applications

The following Microchip development tools are required to run the Location Tagged SOS Curiosity Demonstration:

- PIC32MZ EF Curiosity Development Board (DM320104), available from Microchip Direct
- Download and install latest version of MPLAB X Integrated Development Environment (IDE)
- Download and install the latest version of MPLAB XC32 C/C++ Compiler
- Optionally, download and install the latest version of MPLAB® Harmony Integrated Software Framework

Note:

1. Using the MPLAB Harmony Integrated Software Framework will extend the functionality of this project by adding new modules and libraries to the project.
2. This application project is developed using the following tools:
   - MPLAB X IDE v4.05
   - MPLAB XC32 C Compiler v1.44
   - MPLAB Harmony v2.05
   - MPLAB X IDE plug-in: MPLAB Harmony Configurator (MHC) v2.0.5.2

The following click board from Mikroelektronika is used:

- One GSM-GPS click board (MIKROE-2382)

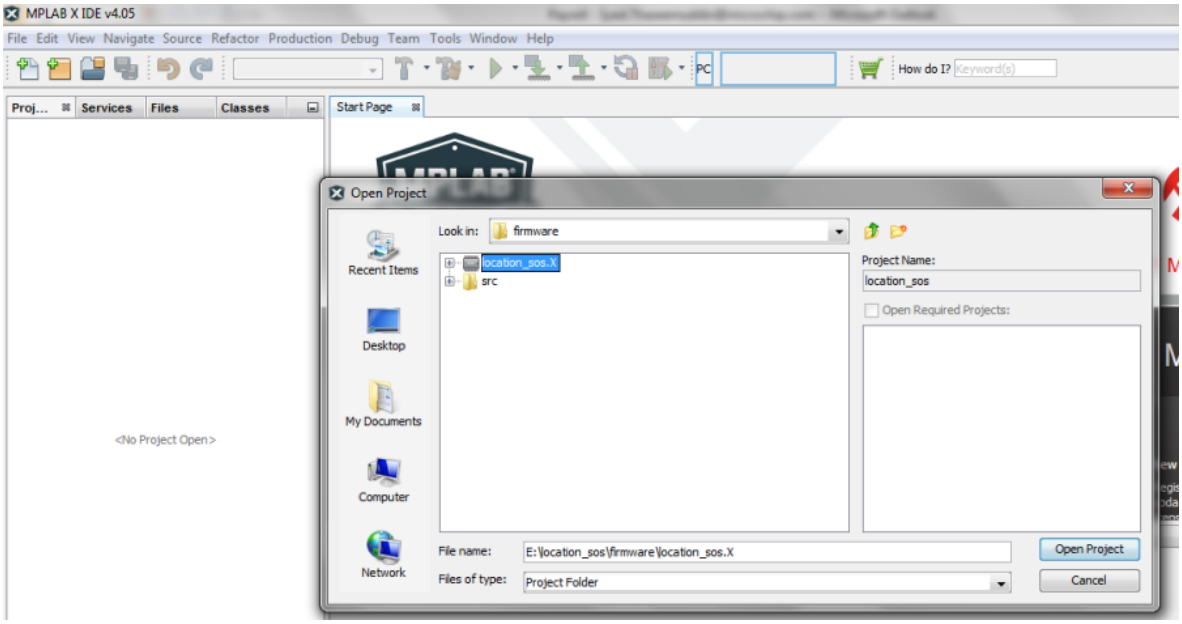
The following antennas from Mikroelektronika are used:

- One GSM Antenna SMA straight male (MIKROE-373)
- One Active GPS Antenna (MIKROE-363)

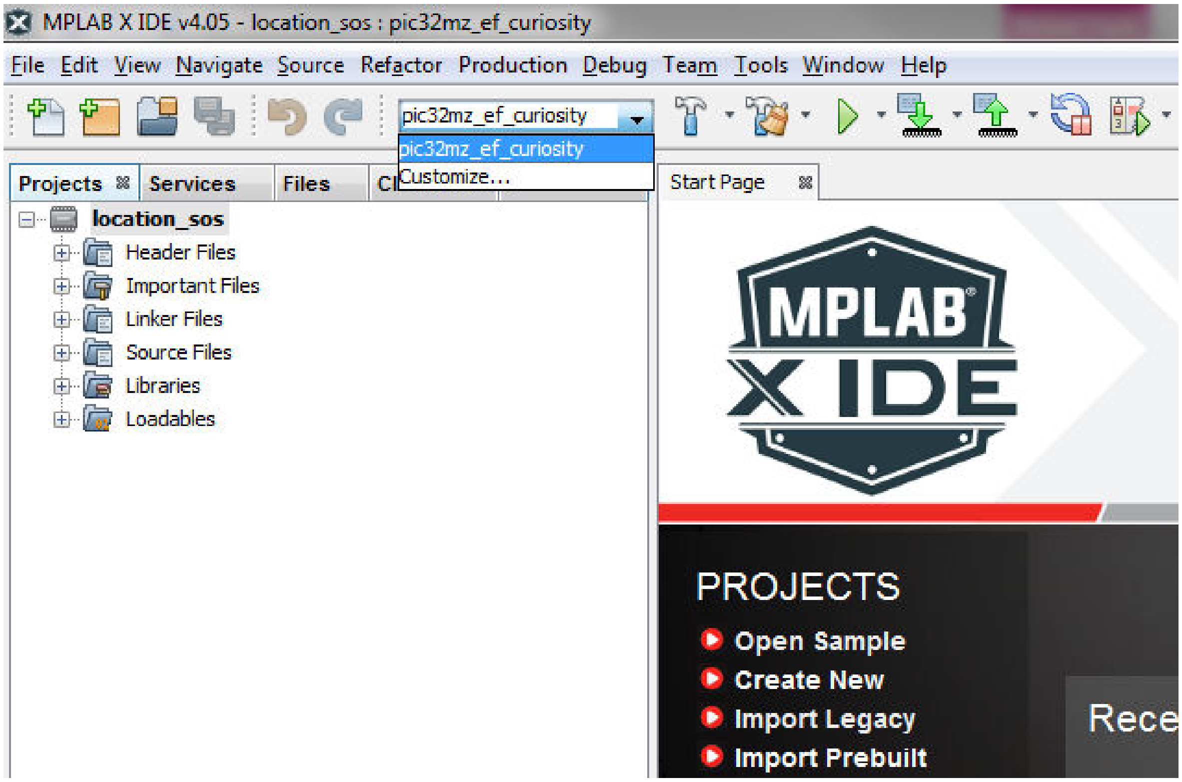
2. Building the Application

To build the application, use the following steps:

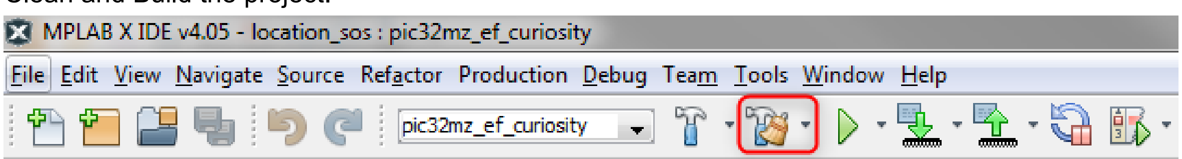
1. Download the **location_sos** project to the local computer. The location.sos project is available for download from the **Curiosity Demo Examples** tab at http://www.microchip.com/Developmenttools/ProductDetails.aspx?PartNO=DM32004.
2. To build the project, in MPLAB X, *File>Open Project*, and then select the `location_sos.X` project from *<path-of-project-in-your-pc>/location_sos/firmware* in MPLAB X IDE, as shown in the following figure.



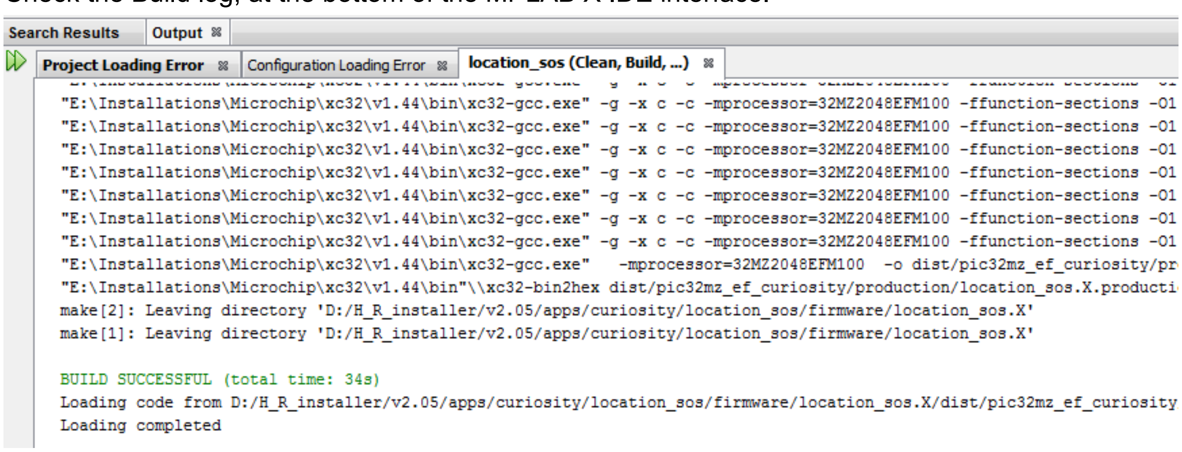
3. The project has only one configuration, *pic32mz_ef_curiosity*, for the PIC32MZ EF Curiosity Development Board. This is the default configuration when the project is open.



4. The *pic32mz_ef_curiosity* configuration arranges MPLAB X IDE to build and run the demonstration application on the PIC32MZ EF Curiosity Development Board, with the PIC32MZ2048EFM100 microcontroller.
5. The UART driver is configured to use the UART1 instance of the peripheral at 115200 baud, 8 bits, No parity and 1-stop bit. The application interacts with the SIMcom's SIM808 based GMS-GPS module (available on the GSM-GPS click board) over UART1 to implement the host side of the application.
6. Clean and Build the project.



7. Check the Build log, at the bottom of the MPLAB X IDE interface.

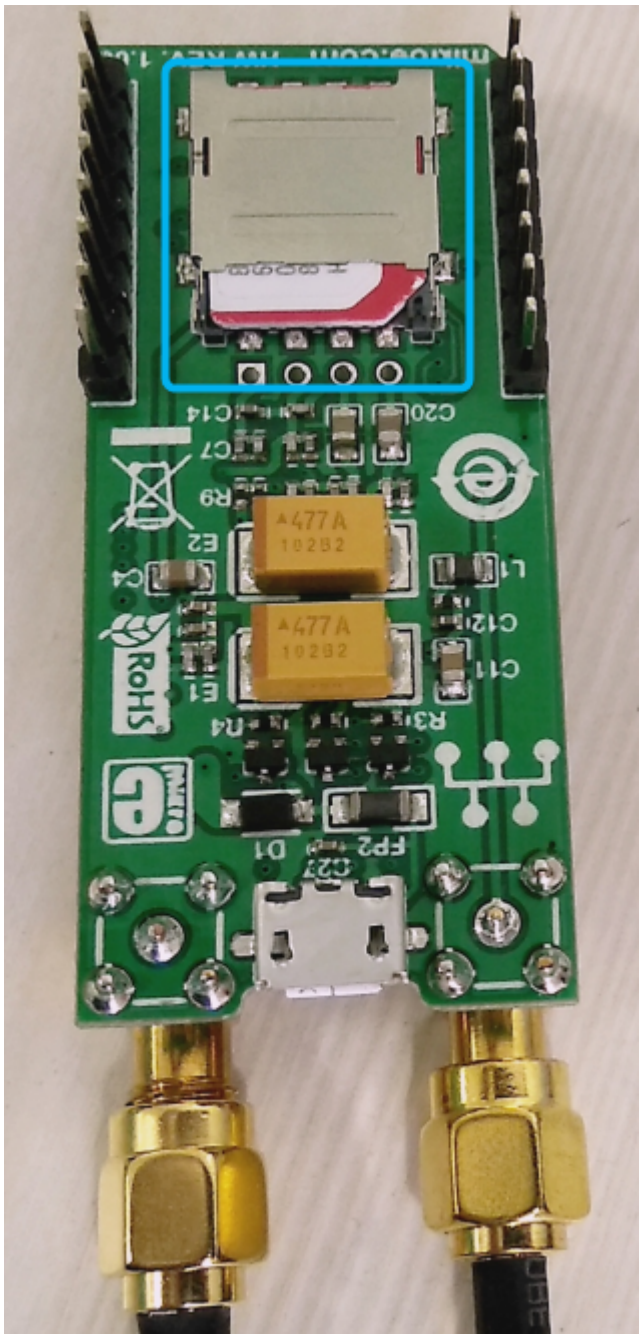


Note: Often a project will not compile on a Windows™ computer due to limitations in the path length. The Windows operating system has a maximum path length of 260 characters. This limitation causes file paths to be truncated when attempting to compile, which leads to files not being found by the compiler. Try placing the project in the top level directory, usually C:/. For additional information, refer to the "Maximum Path Length Limitation" section of the Naming Files, Paths, and Namespaces, which is available on the Microsoft® Developer Network site: https://msdn.microsoft.com/en-us/dn308572.aspx.

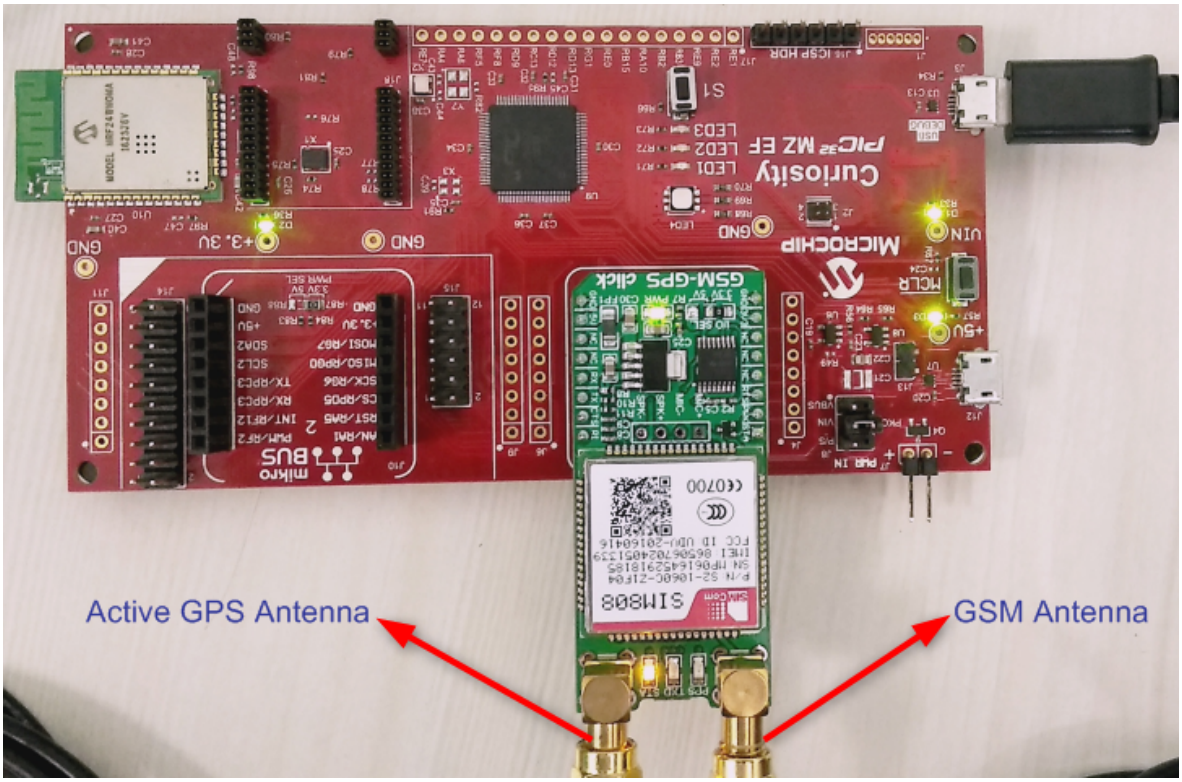
3. Configuring the Hardware

To configure the hardware, perform these actions:

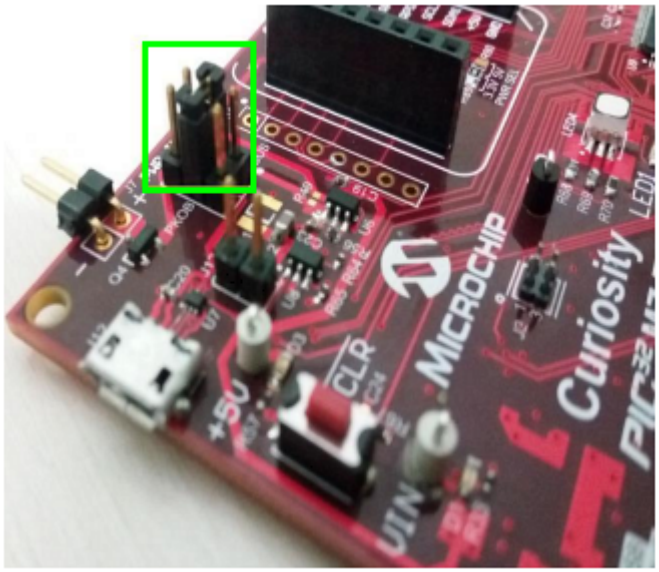
1. Insert a GSM SIM card on the GSM-GPS click board.



2. Mount the GSM-GPS click board on the mikroBUS socket J5, and connect the GPS and GSM antennas.



3. Power the PIC32MZ EF Curiosity Development Board from a host PC through a Type-A male to Micro-B USB cable connected to Micro-B port (J3). The cable is not included with the kit. Ensure that a jumper is placed in J8 header (between pins 4 & 3) to select the supply from the debug USB connector.



For additional information on the hardware features and configurations, refer to the PIC32MZ EF Curiosity Development Board User's Guide (DS70005282).

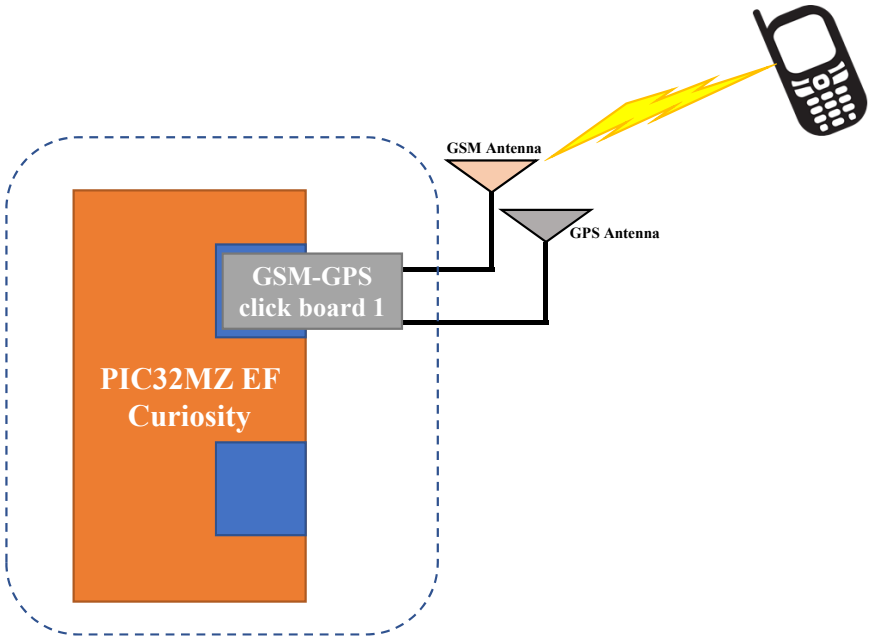
4. Running the Demonstration

This application demonstrates the indication of a personal emergency, or communicates a distress signal by sending out a location tagged SOS SMS.

The GSM-GPS click board, used in this application, contains a hardware module that combines the GSM/GPRS and GPS functionality used for tracking the device and sending out the emergency or distress signal.

The following figure represents the functional block diagram of the application.

Figure 4-1. Function Block Diagram



On power up, the application interacts with the GPS module on the GSM-GPS click board over the UART interface to perform the acquisition and tracking of GPS satellites. It registers the event callbacks for location tracking of the GPS receiver.

The application arranges the GSM/GPRS module for sending SMS to a configured mobile phone number. Once the GPS position is available, the application sends the following location tagged SOS SMS to the configured mobile phone number.

PIC32 Curiosity Location tagged SOS.

Please attend emergency at:

Latitude : xx.xxxxxx

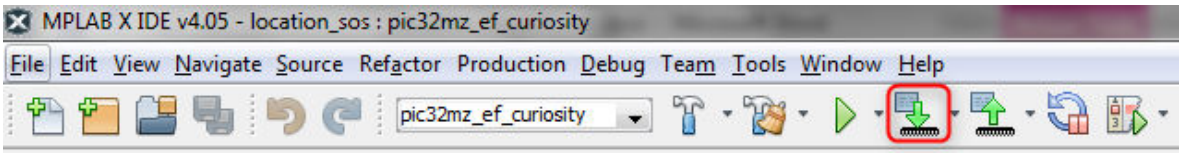
Longitude : xx.xxxxxx

Altitude : xx.xxxxxx

The application also provides the feature to send the location tagged SOS SMS with latest location parameters, every time the switch button on the board is pressed.

The following steps are used for running the demonstration:

1. Open the project in MPLAB X IDE and select the PIC32MZ EF Curiosity project configuration.
2. To configure the Mobile phone number, follow these steps:
   - To configure mobile phone number, from the project, open the source file *gsm_gps.c*.
   - Navigate to the declaration of macro **M_MOBILE_NUMBER** .
   - Change the definition of the macro to the mobile phone number. The mobile phone number should be preceded with the country code, for example, a mobile phone number from India is “8861506700,” and it should be preceded with the country code +91. Therefore the macro should be defined as **#define M_MOBILE_NUMBER "+918861506700"**.
3. Build the code and program the device by clicking on the program button as shown in the following figure.



4. After power up, The LEDs on GSM-GPS click boards gives the following indications:
   - LED marked STA is on, this indicates the GSM module is switching on.
   - LED marked TXA is blinking, this indicates the GPS acquisition and position data exchange by the receiver.
   - LED marked PPS is off. The PPS LED indicates pulse-per-second signal for precise timing. It glows on, after successful positioning.
5. After one minute, the GPS achieves successful position as indicated by the blinking of LED PPS.
   Note:
   1. The GPS on the GSM-GPS click has a one second Time-To-First-Fix (TTFF) from a hot start and 30.
   2. If the position is not achieved after 1 minute, then:
      - It could be because of non-availability of GPS signals. Make sure that you have placed the GPS antenna such that it can receive the signals from the GPS satellites. Try placing it under the open sky to be able to receive signals.
      - After using the option above, if the device is still not receiving the position indication, try resetting the board by pressing the switch CLR on the board. Pressing the switch CLR resets the board and restarts the position acquisition and tracking. The position indication should appear in about a minute, and should receive the location tagged SOS SMS to the configured mobile number.
6. Once the position is achieved, the application sends the location tagged SOS SMS to the mobile number configured in Step 2.
7. The application also allows a user to send an SOS SMS in case of an emergency by pressing the switch S1 on the PIC32MZ EF Curiosity Development Board. This SOS trigger is indicated by toggling of LED1, LED2, and LED3 together on the PIC32MZ EF Curiosity Development Board.
8. Step 7 may be repeated multiple times to indicate multiple emergency situations by pressing the switch S1 on the PIC32MZ EF Curiosity Development Board. Every time an SOS is triggered the application gets the latest location from the GPS receiver, tags it to the SOS SMS, and sends it to the configured mobile phone number.

Note: The latitude and longitude values received in the SOS can be placed on maps.google.com (or on Google Maps App on an Android™ or iOS phone) to see the position of the receiver (PIC32MZ EF Curiosity Development board).
For example, the mobile phone will receive an SMS similar to the following:

PIC32 Curiosity Location Tagged SOS.

Please attend emergency at:

Latitude: 12.982458

Longitude: 77.721540

Altitude: 941.100

Open the Google Map App (maps.google.com) and in the search bar enter the latitude and longitude values separated by a comma, (For example, "12.982458, 77.721540") and tap the search button. The following image shows the procedure for an Android phone.

Figure 4-2. Google Map on Android™ App

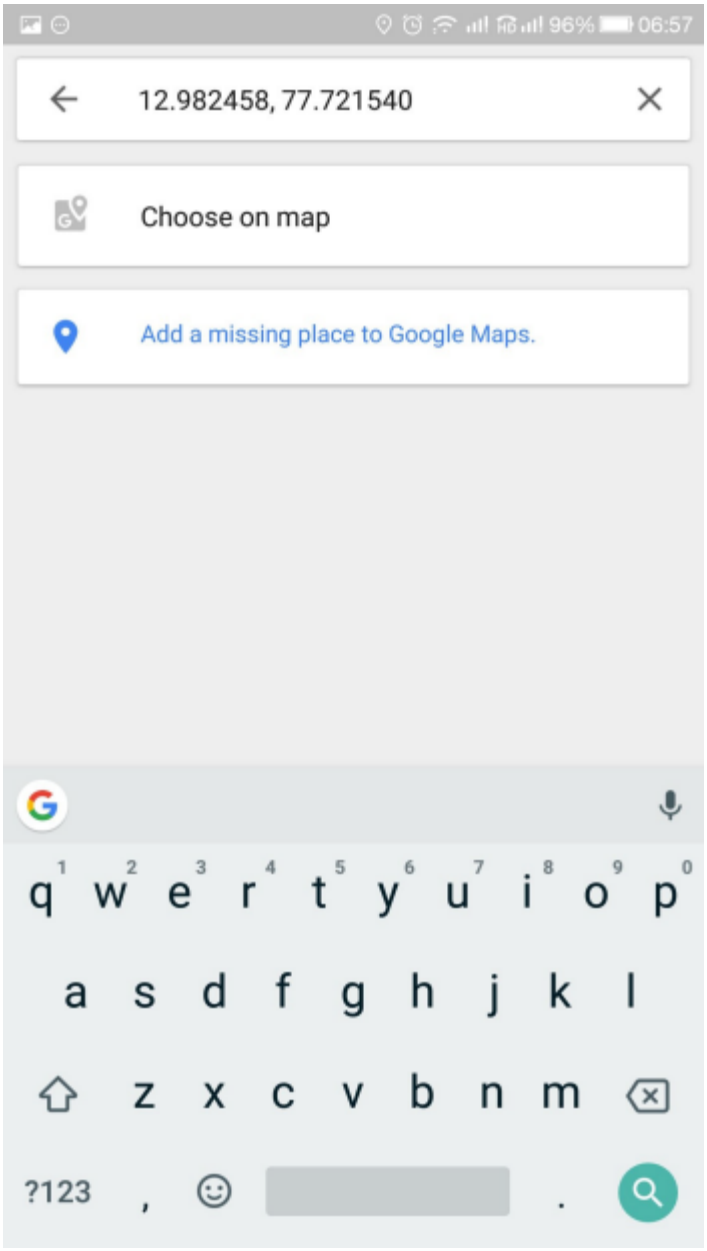
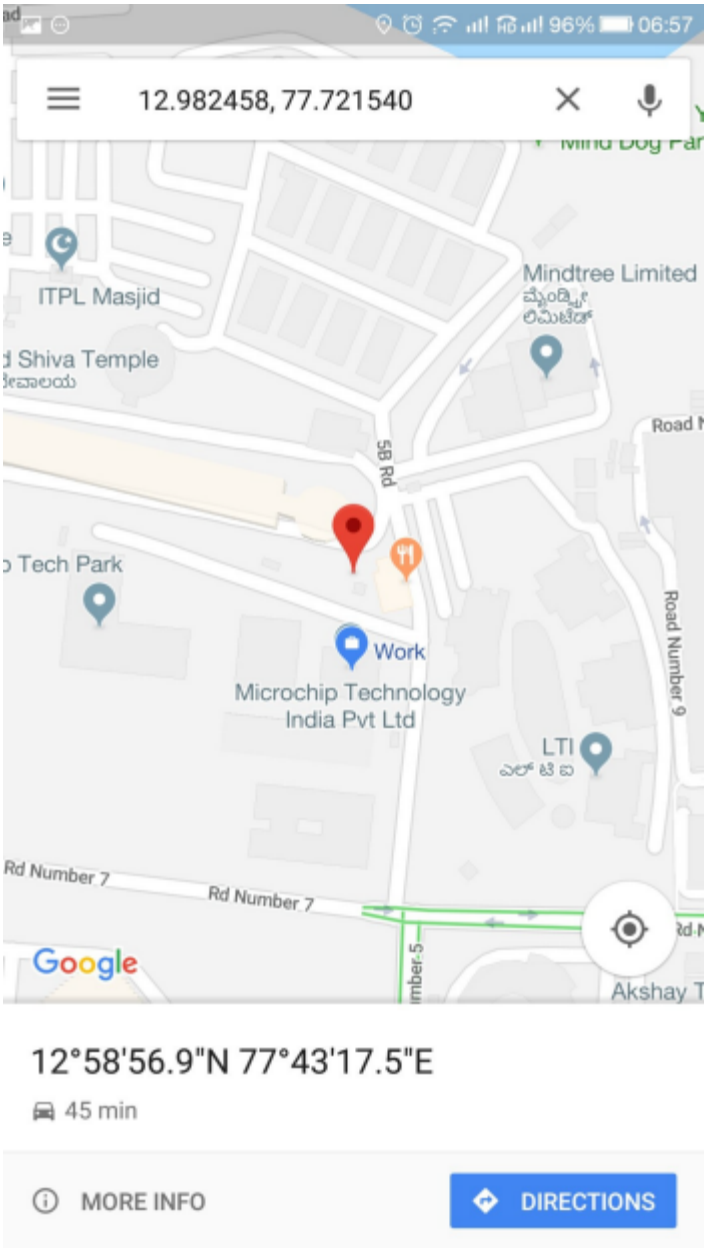


Figure 4-3. Location on Google Map



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