WAYPOINT NAVIGATION

Internship Project

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OBJECTIVE

The Objective of the project is to send the ground vehicle to a prefixed location when a single command is given to it from the mobile application through which we allow the user to control the ground vehicle.

Abstract

The Instructables guide on building a GPS(global positioning system) -guided robot outlines the process of creating a robot that autonomously navigates using GPS coordinates. The project uses a microcontroller (Arduino), GPS module, and motor controller to direct the robot's movements. With step-by-step instructions, the tutorial covers wiring, coding, and testing, allowing the robot to travel to predetermined waypoints based on GPS signals. It's an ideal project for hobbyists looking to learn about robotics, GPS technology, and autonomous systems

PROBLEM STATEMENT

The project addresses the challenge of efficiently controlling ground vehicles remotely by solving the problem of complex manual navigation, allowing users to autonomously send vehicles to a predefined location with a single command, reducing the need for continuous human control and intervention.

Challenge:-

Complex manual navigation of ground vehicles.

Solution:-

Autonomous navigation to predefined locations.

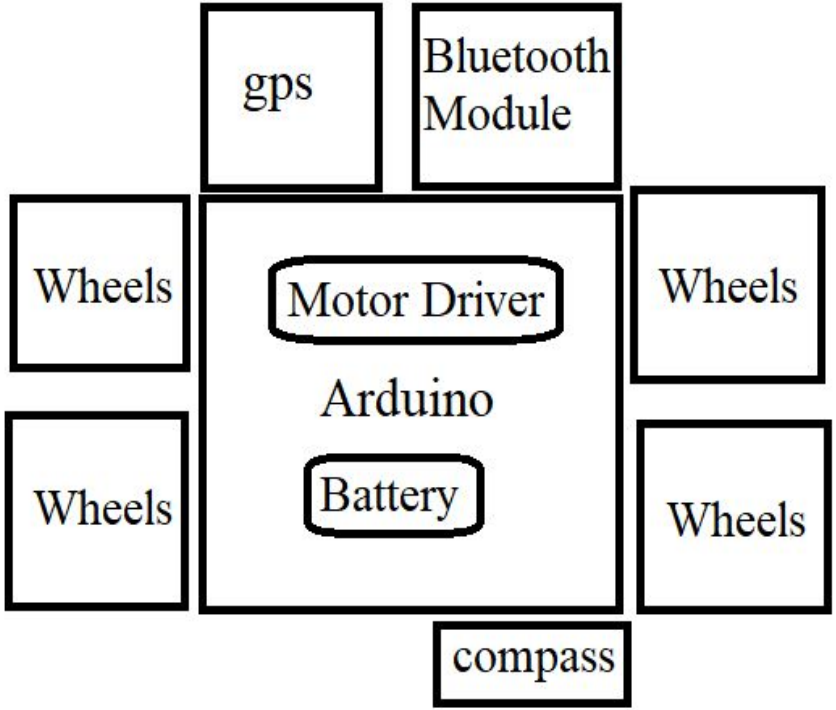
Benefit:-

Reduced human control and intervention in vehicle operation.

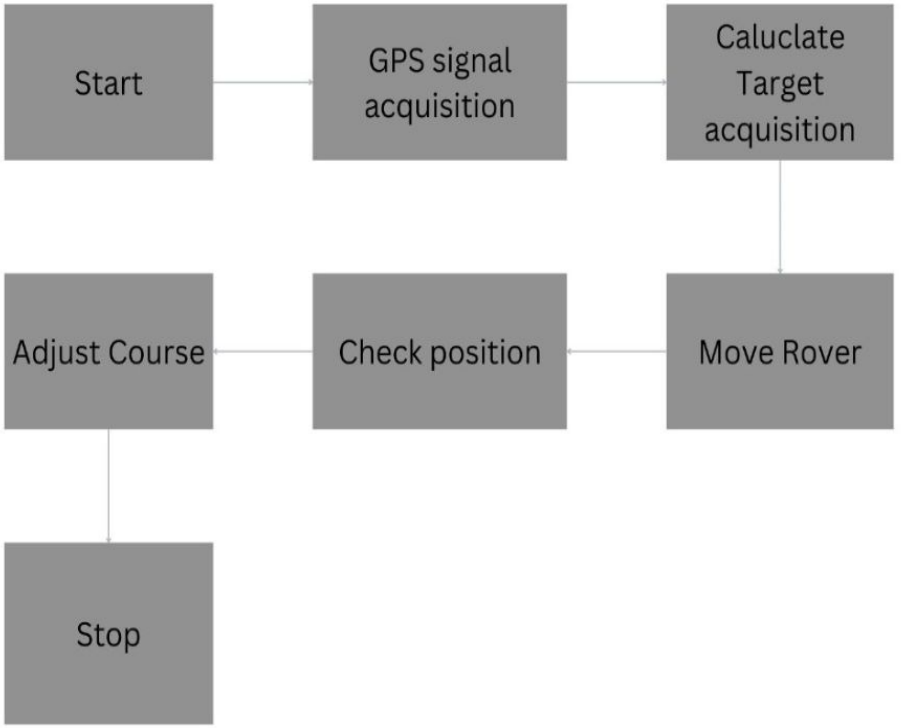
APPROACH USED

We used Arduino Mega 2560 to connect the GPS module , bluetooth module, motor drive and compass as the main components for the functionality of our project.

An application was developed using the MIT app inventor website and app to control the UGV(unmanned Ground Vehicle) from our mobile phone by connecting to the bluetooth module.



Schematic Diagram of Connections



Flow chart of Navigation

COMPONENTS USED

HARDWARE COMPONENTS:

Arduino mega 2560

Motor shield L293D

Bluetooth module

GPS Ublox Neo 6M

Compass HMC5883L

Dc Motors 4

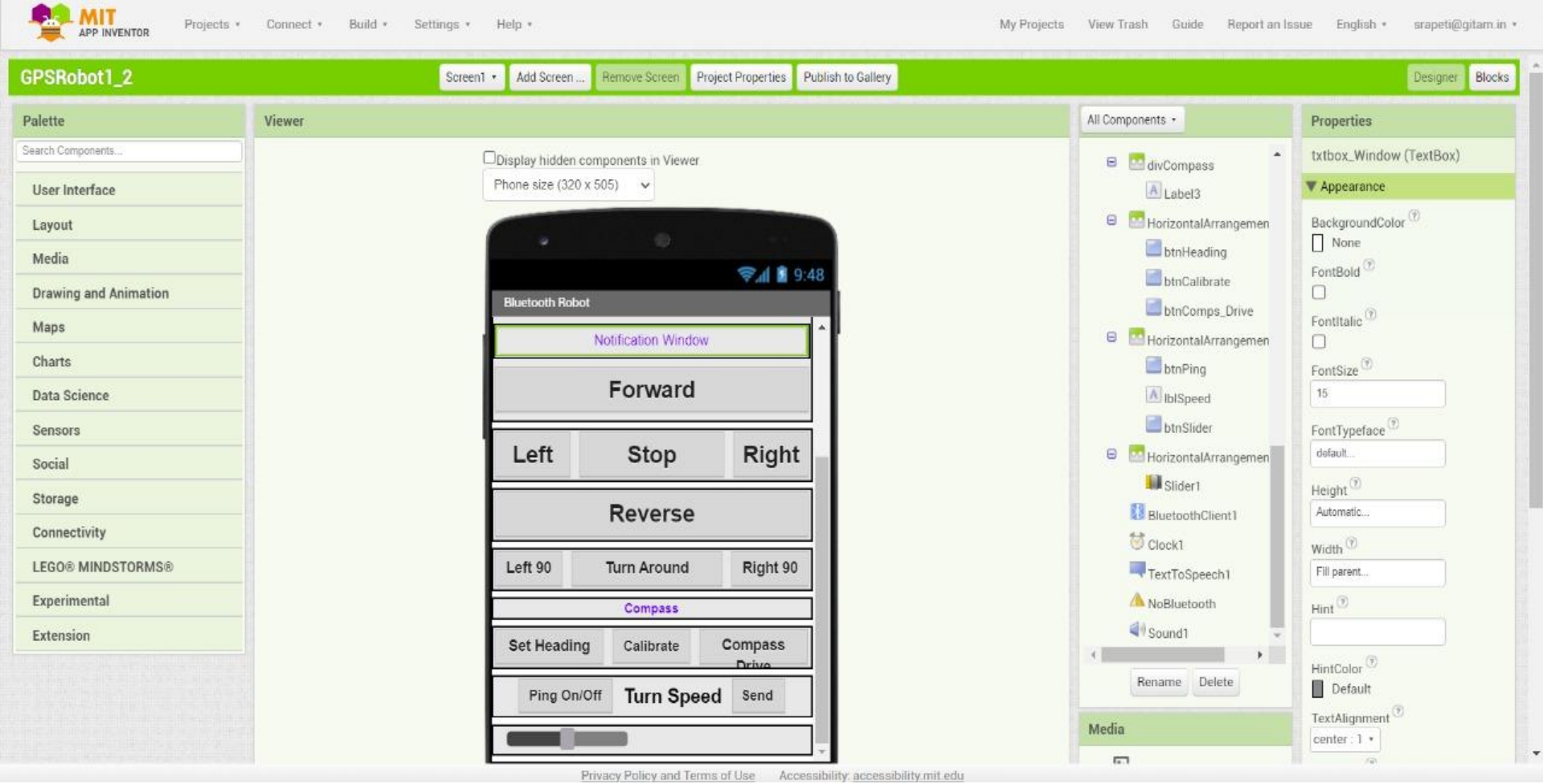
Wheels 4

Battery and Jumper wires

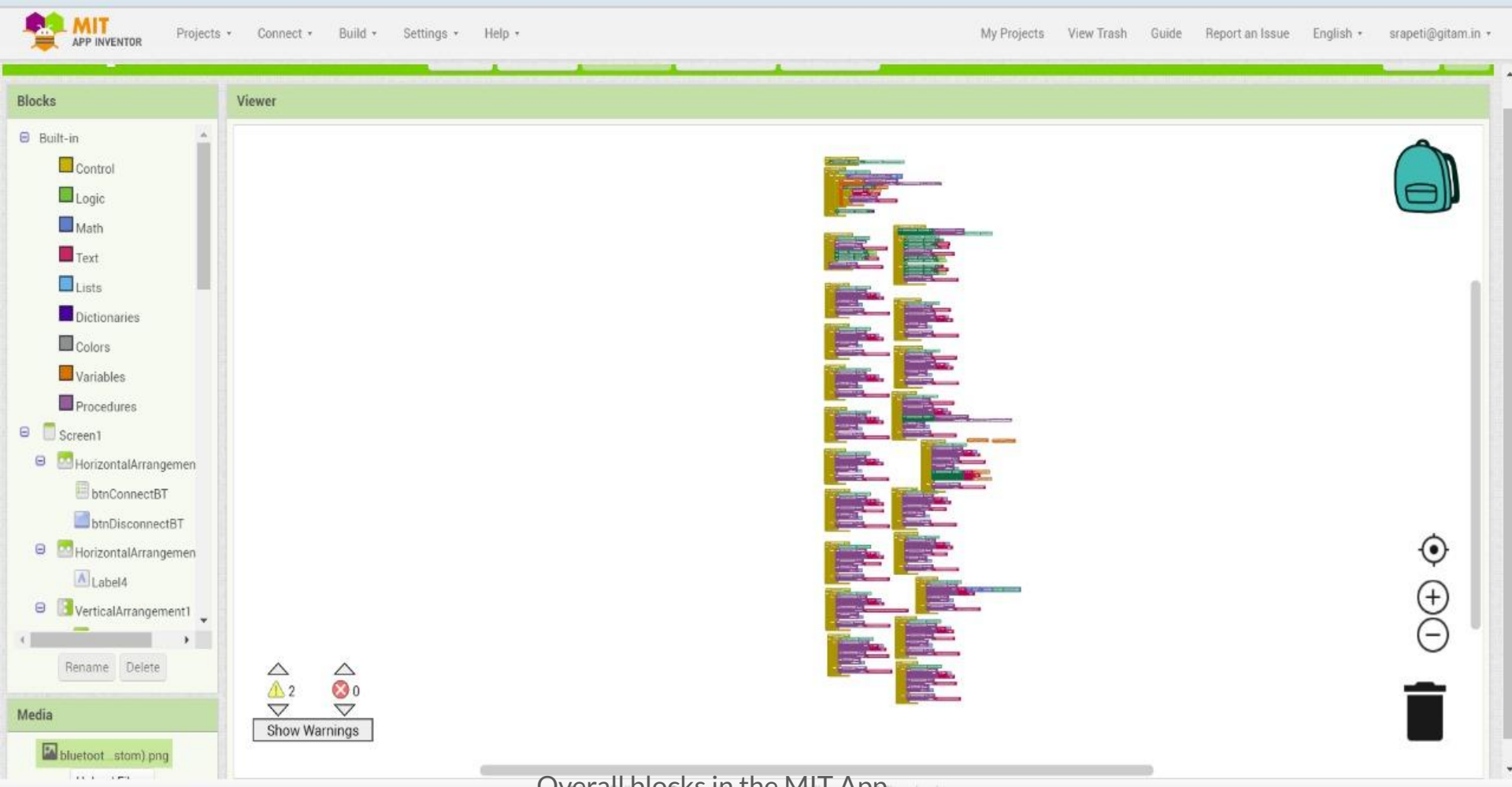
SOFTWARE REQUIREMENTS:

Arduino IDE (required libraries based on the components)

MIT app inventor(website account and mobile app)



Interface of MIT App inventor



Overall blocks in the MIT App

Stages of the project

Stage 1:- Bluetooth car

Initially a simple model where we control the car using the bluetooth module from the created app.

Stage 2:- app development

Making an interface for controlling the bluetooth car using the MIT app inventor.

Stage 3:- Attached the compass

Then compass is connected and calibrated and entered the offset values in the main code.

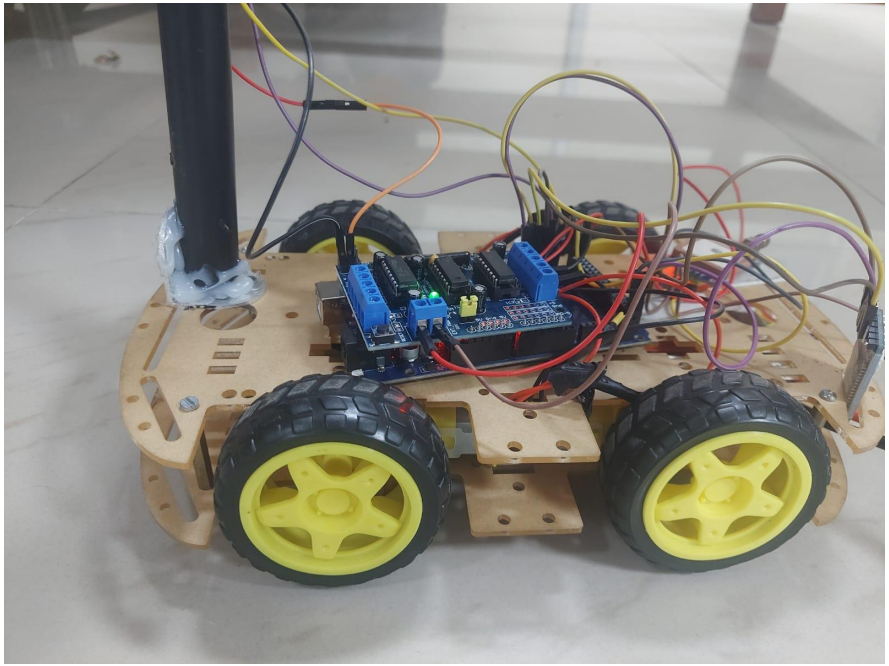
Stage 4:-GPS module

The GPS module is receiving and storing the latitude and longitude values for navigation.

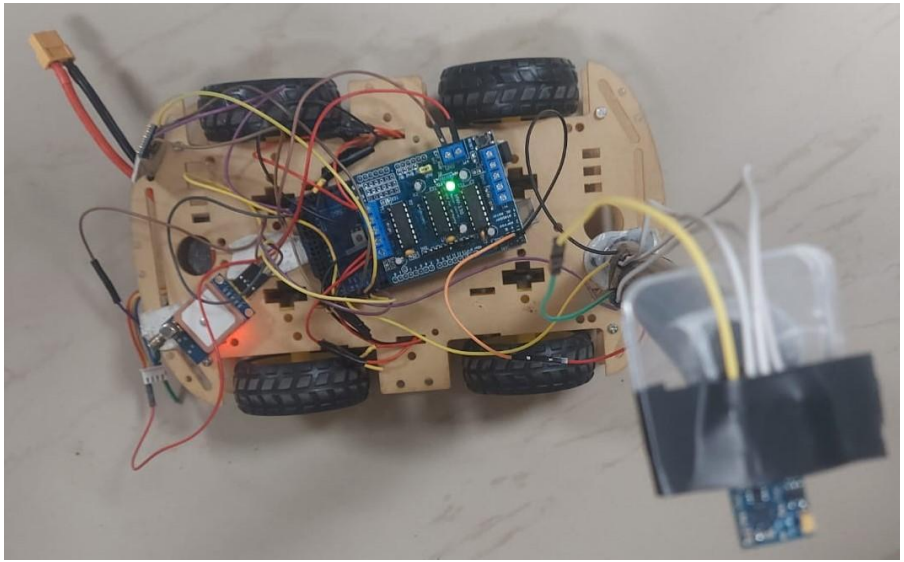
Methodology to go to the waypoint

1. **Initialization**: The robot's GPS module acquires satellite signals to get real-time coordinates.
2. **Path Calculation**: The microcontroller compares the current GPS coordinates with the predefined target location and computes the distance and direction.
3. **Movement**: Based on direction calculations, the robot moves forward, adjusts motor speeds, and steers accordingly using DC motors.
4. **Course Correction**: Periodically recalibrates its direction using updated GPS signals to ensure it stays on track.
5. **Final Destination**: The robot stops when it reaches the predefined GPS coordinates within a specified threshold range.

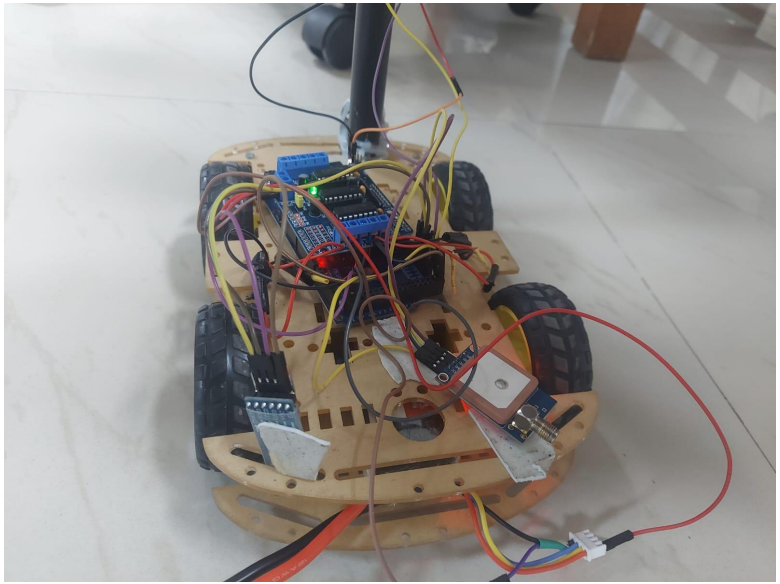
Project



Side view



Top View



Front View

App interface Look

Flow of project in the app

1. Connects to the Bluetooth
2. Uses the ‘Set Way ’ button in the app to fix a waypoint. We can provide upto 5 waypoints in the app. Then click on ‘Done’.
3. Now when the UGV is away from the desired point. Click on the ‘go to waypoint’ to send it to that location.
4. If we give more than 1 waypoint , once the first one is reached click on the ‘ go to waypoint’ to go to the next destination.

Weekly Report

S no.	Week	Work done
1.	1st Week	Learned about the hardware requirements , researched papers
2.	2nd Week	Integration of components
3.	3rd Week	Created an application in mobile phone using mit app inventor
4.	4th Week	Documentation and working of gps guided robot

Future challenges:

- Obstacle Detection and Avoidance
- Indoor Navigation
- Weather and Environmental Conditions
- GPS Accuracy and Reliability

CONCLUSION

We have successfully established the connections between the hardware components using the Arduino mega 2560. Also integrated the bluetooth module with the created application.
The unmanned Ground Vehicle (UGV) is reaching the prefixed waypoint while controlling through the app.

THANK YOU