

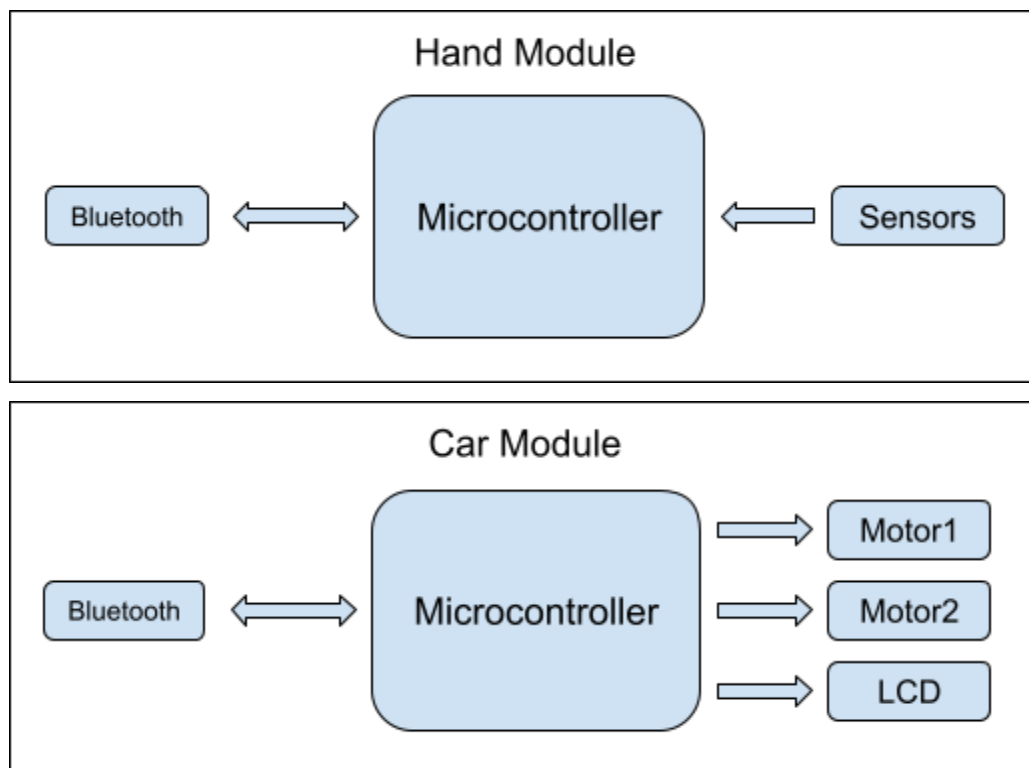
## Embedded Systems Diploma

### Graduation Project

### CAR CONTROL

#### Project Requirements

This project aims to control a car's speed and direction using hand's motion or fingers' motion. There are two modules required: Hand Module and Car Module. The hand module consists of a microcontroller, flexible sensors, and bluetooth. The car module consists of a microcontroller, DC motors, LCD, and bluetooth.

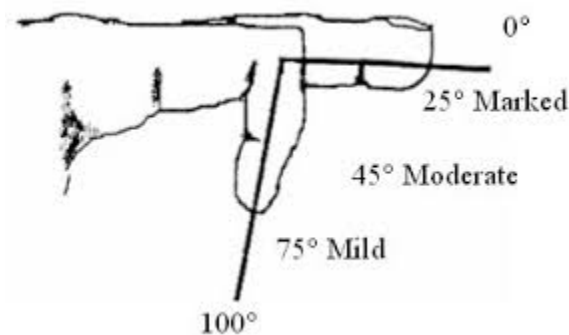


The Hand Module should have a fast response in detecting fingers' posture and continuously sending updated data to the car's module. The Car Module on the other hand has to receive the updated data and quickly adjust its motion. The fingers' posture should translate into the car's speed and direction.

(Note: Since this project will be demonstrated as a simulation on Proteus, variable resistors could be used instead of flexible sensors.)

## Analysis

To achieve the required functionality, a good approach is dividing the range of the flexible sensors so that the central value represents the neutral position of the finger which signals stopping. For example, if the finger has a range of 100 degrees, having the finger around 50 degrees should signal stopping. It is inconvenient to define the stop signal as exactly 50, so it could be the range from 40 to 60 degrees, or 45 to 55 degrees for instance.

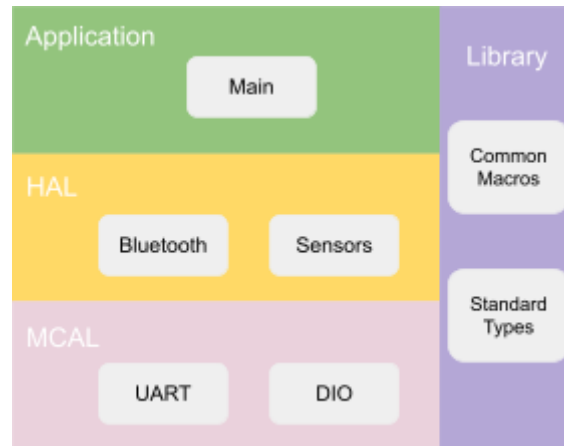


If the finger is at an angle lower than the neutral position (below 40 degrees), it should signal a motor moving forward, and if the finger is at an angle higher than the neutral position (above 60 degrees), it should signal a motor moving backward. Since there are two motors, two fingers can be used to control each motor. The speed could be controlled by a third finger, or it could be using the same two fingers.

If a third finger is used, then the first range for that finger should mean zero speed, then the higher the angle, the higher the speed. However, if the same two fingers are to be used, then the speed will depend on how far the finger is from the neutral position. So, below 40 means moving forward, but the nearer it is to zero, the higher the speed. And, above 60 is moving backwards, but the nearer it is to 100, the higher the speed.

## Software Design

Shown below is the layered architecture for the Hand Module. The main program uses the sensors module to receive current values from the sensors, and uses the bluetooth module to send data from the Car Module. The bluetooth module needs the UART module to send and receive data. The sensors module needs the DIO module to read data from the input pins.



Shown below is the layered architecture for the Car Module. The main program uses the bluetooth module to receive data from the Hand Module, uses the DC motor module to control the two motors depending on the received data, and uses LCD module to display the current state. The bluetooth module needs the UART module to send and receive data. The LCD module needs the DIO module to display data by writing to the output pins. The DC motor module needs the PWM module to control the speed.

