# Project Name

# Abstract

The product that we aim to develop is a **Vehicle Accident Prevention System (VAPS).** The system itself will consist of 4 individual and structurally identical yet aesthetically different node modules and 1 coordinator module.

Each node will have the following:

1. 1 XBEE 802.15.4 RF module
2. 1 Ultrasonic Ranging Module HC-SR04
3. A protective outer layer of coating made of silicone rubber, 0.5’’ thick

The coordinator module will have:

1. 1 XBEE 802.15.4 RF module
2. 1 Arduino microprocessor

Each sensor will be connected to an XBEE module as part of a wireless network. Each of these XBEE modules will act as end-points. The sensors work as follows: eight 40 kHz signals are sent and it is detected whether or not a pulse signal is returned back. The data that needs to be passed to the coordinator module is the time signal between sending the trigger signal and receiving an echo signal. Using this data, the distance between objects can be calculated using a program coded into the Arduino microprocessor. After the data has been processed, it can be passed to Android via Bluetooth communication. We require a Slave module, and we have several to choose from. Currently, our most viable option is JY-MCU.

# Facets

As our project requires several individual components, we will be discussing the most viable options available to us currently as well as other alternatives that can be used. We will be covering the sensors used to detect the distance to other vehicles, the outer covering of the entire module, the connectivity modules and the power source for the module.

## Sensors

The sensor we will be using is the Ultrasonic Ranging Module HC-SR04, the details of which are listed below:

|  |  |
| --- | --- |
| **Range** | 2-400 cm |
| **Working Voltage** | 5 V DC |
| **Working Current** | 15 mA |
| **Working Frequency** | 40 Hz |
| **Dimensions** | 45 x 20 x 15 mm |

The sensors in each module will be aligned so that one sensor scans the region directly in front of its location (i.e. the front and back of the vehicle) while the other sensor is aligned perpendicularly to this sensor (so as to scan the distances on the sides of the vehicle). Together, the 4 modules will create a composite view of the car to warn users of the location of where a collision is to be expected.

## Outer Covering

The outer cover will be made of silicone rubber. Considering we take a thickness of ¼ inch, this material costs $0.27 for a cuboid of size 1’’ x 1’’ x ¼’’ (at current exchange rates, ₹18.51). Silicone rubber has several properties that make it useful for our product:

1. Good resistance to temperatures, with a working range from -100 to 300⁰ C
2. Inertness with relation to most chemicals
3. Retention of initial shape and mechanical strength

## Connectivity

In order for the sensors to transmit data to the application, we have selected the XBEE 802.15.4 RF module. For our product, the primary demand will be to have robust point-to-point communication with minimized latency, and these modules can satisfy this requirement. The details of these sensors are outlined below:

|  |  |
| --- | --- |
| **RF Data Rate** | 250 kbps |
| **Urban Range/Outdoor Range** | 100 feet/300 feet |
| **Supply Voltage** | 2.8-3.4 V DC |
| **Dimensions** | 27 x 24 mm (thickness negligible) |

## Power Source

In order to run the module to transmit data to the application, we have selected the rechargeable lithium-ion battery. The details of these battery are outlined below:

* Dimensions: 0.87" x 1.50" x 0.15" inch
* Voltage: 3.70V
* Capacity: 400mAh