RISC-V Product Development Hackathon

Stage 1-Product Idea Submission Form

1. Product Title

   Gesture-Driven Robotic Control System with RISCDUINO-board Integration

2. What does your product do?

   The primary action or feature of the "Gesture-Driven Robotic Control System with RISCDUINO Integration" is "Control and Navigation through Gestures." This means that the product allows users to control the robot's movement and actions using hand gestures, providing an intuitive and interactive way to guide the robot's behaviour.

3. What all interfaces of the board will used in the product?

   In the "Gesture-Driven Robotic Control System with RISCDUINO board Integration" project, the following interfaces and connections of the RISCDUINO board will be utilized:

   GPIO Pins: *We will employ the available 38 GPIO (General Purpose Input/Output) pins for motor control. These pins will be responsible for sending signals to the motor driver to control the robot's movement based on the gestures detected by the sensor.*

   UART (Universal Asynchronous Receiver-Transmitter): *The UART communication capability of the RISCDUINO-board via IO5, IO6 pins can be utilized for the radio frequency communication for the gesture control with the system. This communication will facilitate the exchange of data and commands necessary for interpreting and executing gesture-based control instructions.*

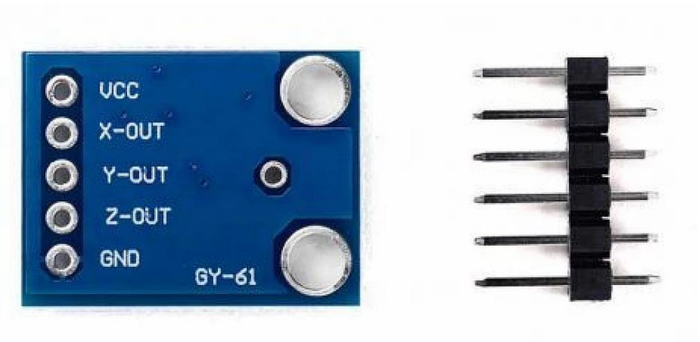
   SPI (Serial Peripheral Interface): *The SPI interface available through U_SI, U_RX, U_TX, U_CS pins will be used for communication between the RISCDUINO board and any additional sensors or modules that will be integrated into the system. This allows for expandability and the incorporation of various sensors to enhance the robot's capabilities.*

Power Supply: *The power supply pins on the RISCDUINO board marked via J2 pin will provide the necessary voltage and current to drive the motors, sensors, and other components of the robot. This includes connections to the motor driver and any auxiliary components.*

By utilizing these interfaces and connections on the RISCDUINO board, we can effectively integrate gesture control capabilities into our robotic system, allowing for intuitive and hands-free control of the robot's movements and functions.

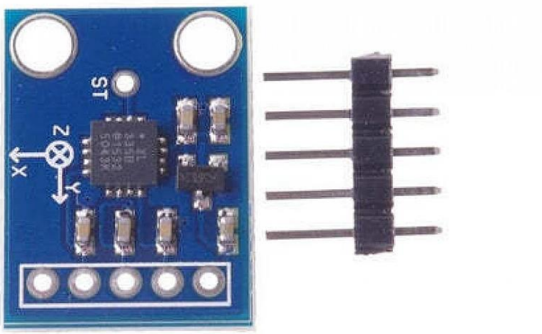
4. Does the product utilise sensors?
   Yes

5. If "Yes" for above question, then list your sensors here.
   ADXL335 Module - 3 Axis Accelerometer



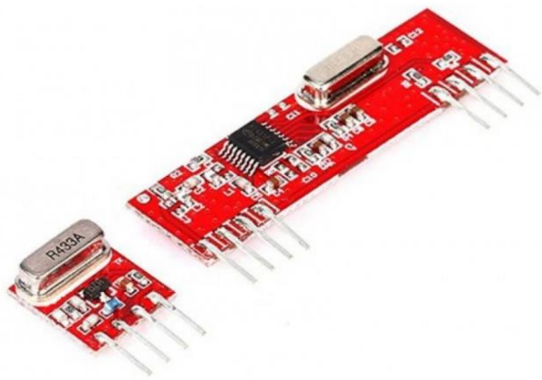
The ADXL335 is low power, a complete 3-axis accelerometer with signal conditioned voltage outputs. The ADXL335 Module is a 3-axis Analog Output Accelerometer measures acceleration with a minimum full-scale range of ±3 g.

It can measure the static acceleration of gravity in tilt-sensing applications, as well as dynamic acceleration resulting from motion, shock, or vibration. This breakout board comes with an onboard voltage regulator and works at both 3.3V & 5V (3-5V). An accelerometer is an electro-mechanical device that will measure acceleration forces. These forces may be static, like the constant force of gravity pulling at your feet, or they could be dynamic – caused by moving or vibrating the accelerometer.



RF Transmitter and Receiver Modules

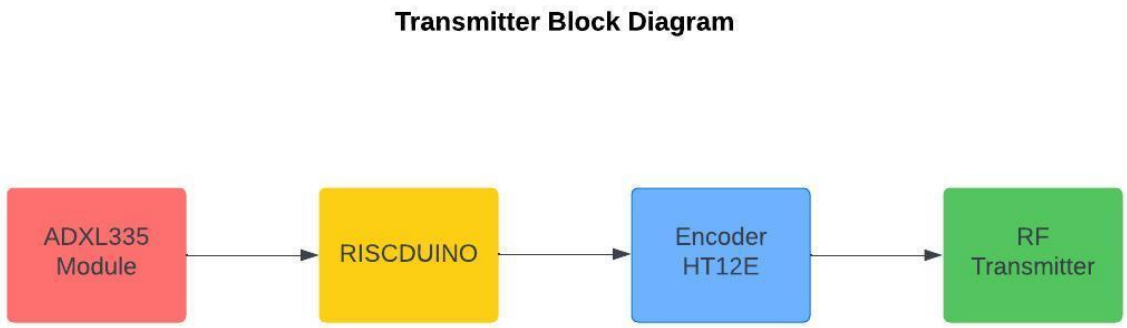
The communication between transmitter and receiver is using RF modules. A 434 MHz transmitter and receiver pair are used in this project.

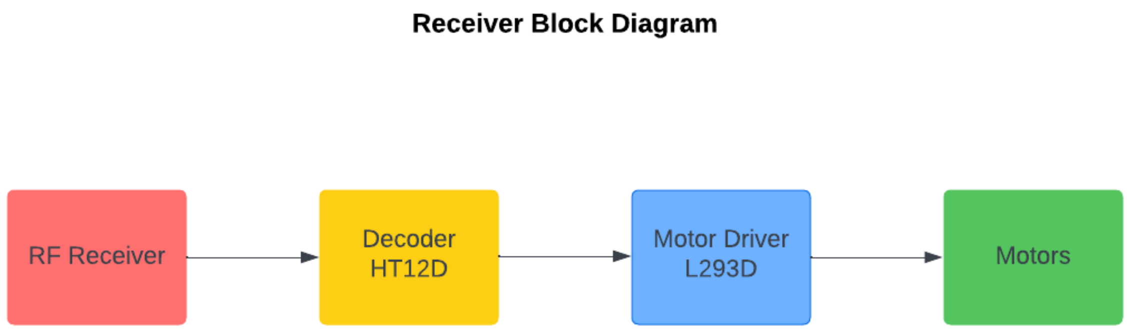


- *HT-12E*
  - *It is an encoder IC that converts the 4-bit parallel data into serial data in order to transmit over RF link.*
- *HT-12D*
  - *It is a decoder IC that converts the serial data received by the RF Receiver into 4-bit parallel data. This parallel data can be used to drive the motors.*

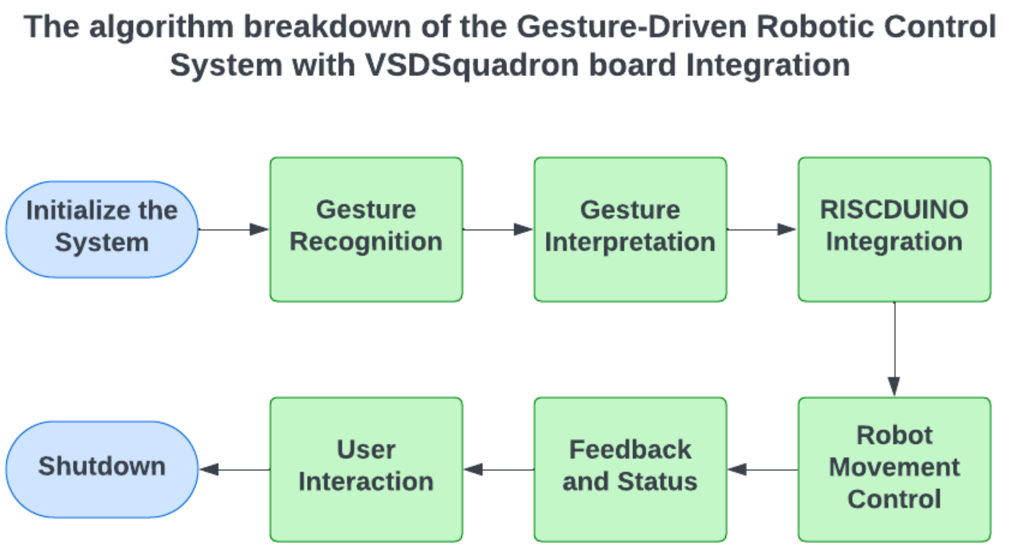
6. Draw a Block diagram of the product.

   A visual representation of different components and how they interconnect.





7. Upload the Algorithm flowchart of the product.



8. Explain the algorithm of the product in bullet points.

The algorithm breakdown of the Gesture-Driven Robotic Control System with RISCDUINO board Integration:

Initialize the System

- *Power on the robotic system.*
- *Initialize all sensors and components.*

Gesture Recognition

- *Continuously capture input from the gesture sensor.*
- *Process the captured gesture data.*

Gesture Interpretation

- *Interpret the gesture data to recognize specific commands.*
- *Translate gestures into actionable commands such as "move forward," "turn left," "turn right," "stop," and others.*

RISCDUINO Integration

- Communicate with the RISCDUINO board to execute the recognized commands.

- Send appropriate control signals to the robotic actuators based on the interpreted gestures.

Robot Movement Control

- Execute the appropriate movement commands received from the RISCDUINO.

- Control motor speed, direction, and duration to achieve desired movement.

Feedback and Status

- Provide feedback on the robot's status and actions.

- Display information such as current direction, speed, and gesture recognition feedback if applicable.

User Interaction

- Continuously wait for new gestures from the user.

- Repeat the gesture recognition and execution loop.

Shutdown

- When the user decides to stop the robot or the system detects a shutdown gesture:

- Stop all motor movements.

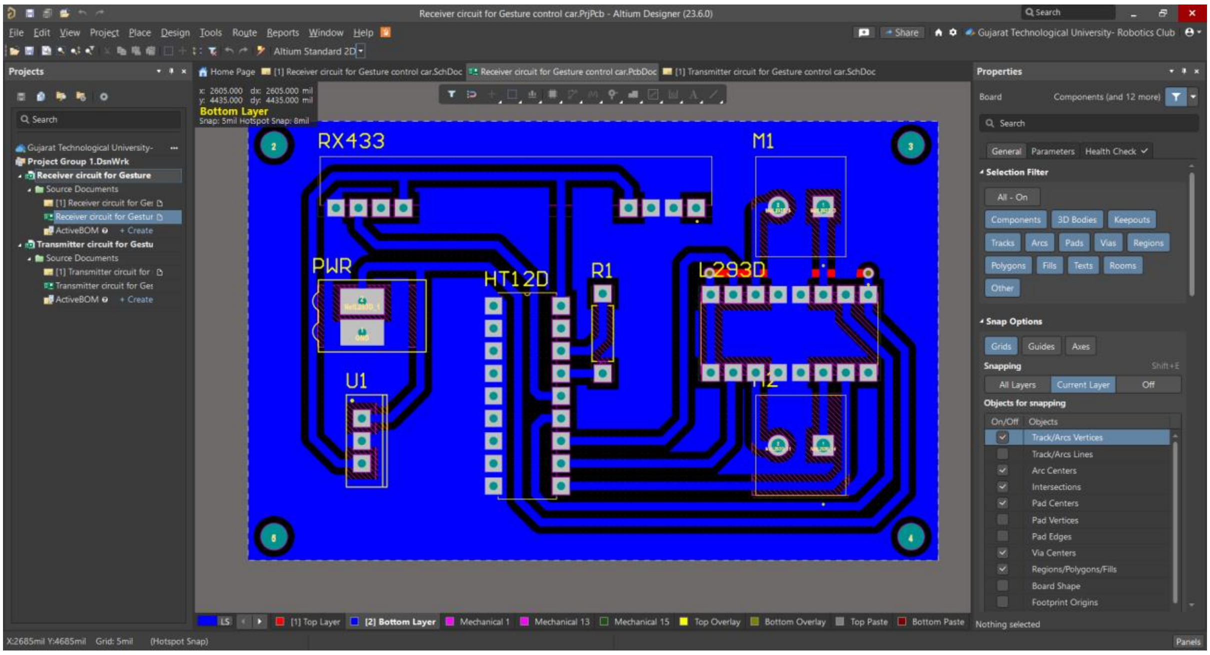
- Power down the system components.

9. Draw a Rough sketch of the final product.

   *A drawn image of how your product will look from the outside. Example: A drawing of the toy car with its wheels, colour design, and size. **

10. Upload the rough sketch of the Internal product (With all connection of components with the board and the product.).

A depiction of the internal layout, showing where the RISCDUINO board and other components will be placed.



***The above figures show the internal connection diagram of the project (still in progress). The connection diagram encompasses of different components which are going to be used in the project.*

11.BoM list (excluding the board) with cost.

Component name	**Quantity Required**	**Unit price**	**Total Price** (Unit price*Quantity)
L293DNE Motor Driver IC	*1*	*80*	*1*80 = 80/-*
DC Motors	*4*	*130*	*4*130 = 520/-*
HT-12D Decoder IC	*1*	*80*	*1*80 = 80/-*
HT-12E Encoder IC	*1*	*80*	*1*80 = 80/-*
433MHz RF Transmitter Receiver Wireless Module	*1*	*200*	*1*200 = 200*
Mechanical Chassis (Robot Chassis)	*1*	*750*	*1*750 = 750/-*
ADXL335 Module - 3 Axis Accelerometer	*1*	*625*	*1*625 = 625/-*
Miscellaneous (330Ω, 33kΩ, 750kΩ resistors, LED, connectors, etc.)	*-*	*200*	*200/- (variable)*

12. Team details

Name	**University/ Organisation**	**Age**	**Gender**	**Current Sem.**	**Current Address**	**Do you need accommoda-tion if the Demo is to done in Bangalore**	**Role in Product Development**
Prem Ranjan Singh	*Gujarat Technological University (Ahmedabad)*	*20*	*M*	*7th*	*Gandhinagar*	*Y*	*Hardware Coding*
Dhruv Gohil	*Gujarat Technological University (Ahmedabad)*	*21*	*M*	*7th*	*Gandhinagar*	*Y*	*Circuit Designing, Embedded System*