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Multi Terrain Motion Control Vehicle

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Abstract: The integration of an increasing number of functions within the Human Machine Interface (HMI) of cars will increase the problem of tool coping with device handling operations. The current work focuses on the concept of using a car-robot that can navigate wirelessly using an Arduino UNO. Robots are now playing a significant role in human lives. The present-day scenario to govern those vehicles are through the use of a keypad, controller or pre-planned commands. The goal of this work is to introduce a new technique to interact with a robot through gestures. The task is to control a robotic vehicle from a distance through hand gestures. The idea has two major factors which is a vehicle and other is the controlling station. The controlling station has a gesture recognition system which will adhere to the instructions and send it to the vehicle. The control station is the microcontroller board Arduino UNO. With the help of the accelerometer, data from hand motions is supplied into the Encoder HT 12E IC via the Arduino UNO. After that, Tx 434 is used to convey the encoded data. The encoded data is received by Rx 434 in the receiver portion, where they are decoded by a Decoder HT 12D IC and transmitted to the L293D part that operates the motor. Thus, vehicle driving motors can be controlled with the instructions received from the vehicle driving motors.

Keywords: Arduino UNO; Hand Gestures; Controlling Station; Decoder HT12D; Gesture Recognition System

I. INTRODUCTION

Gestures can arise through physical motion however they mostly arise from hand or face [1, 2]. Individuals can put in gestures to govern or have interaction with gadgets. Many strategies were made for the usage of cameras and computer imaginative and prescient logics to interpret signal. A robot is a device which can carry out few tasks assigned to it mechanically. Robots can sustain on their own or even can be can be controlled remotely. Robots have arisen to such a scale that they are able to mimic a human being and can also take decisions by themselves. The main aspect of a robot is the way it interacts with human which is through Human Machine Interface [3, 4]. In the past few years, the robotic communication has developed massively which was not easy in the early years and thus requires a lot of hard work. With the advancement of robots gesture control came into existence. Gestures arises from any movement done by our body part, however they basically arises from our palm or face. Gesture recognized are analysed by computer and output is generated and is being considered a form of human interface language [5-7]. With gesture recognition into play there is a lot less need of textual content interfaces. A gesture is a motion that needs to be viewed by a person and has to bring a few pieces of data. Human-robot interaction relies heavily on hand gesture recognition (HRI). For people who are disabled or disadvantaged, signal language is the most natural manner of communication.

The focus of this work is to apprehend hand motions and utilise them to move a vehicle car wirelessly. An accelerometer sensor is used for steering and is a controlled variable. The idea presented in this article may be useful to physically challenged people at large who can easily control their movement by wearing the sensor-based gloves and moving the wheel chair as per their requirement. Further, the idea may find applications in military implementations of using a robot, medical implementations for using robots for surgeries, robots used at building sites, in industries to operate carts etc.

The following is how the paper is structured: The introduction to the current work is presented in the Section I. Section II presents the design of gesture-controlled vehicle followed by components description in Section III. Section IV depicts the results obtained using Arduino code and at the end, conclusion and future scope of the work is presented in Section V.

II. DESIGN OF GESTURE CONTROLLED CAR

The targeted gesture-controlled robot operates on the basis of MPU 6050, which detects a human gesture, analyses the data, and delivers it to Arduino UNO, where the appropriate voltage is applied (both 3V or 0V). MPU-6050 is the similar sensor which is used in our mobile phones to use auto-rotate feature. We will use this module to sense the gesture and then these signals will tell the Robot over the Radio Frequency by using RF Module to tell the Robot in which direction to go [8-10]. As a controller, the Arduino UNO is used. The data is subsequently passed into an Encoder (HT 12E), which prepares it for transmission via RF transmitter. RF434 is the RF module in use here. The RF receiver obtains the statistics at the receiving end, which is then passed on to the decoder (HT 12D). The encoder data is fed into the motor motive force IC

(L293D), which controls the cars in a unique configuration to move the bot in different directions. Figure 1 depicts the overall system's block diagram.

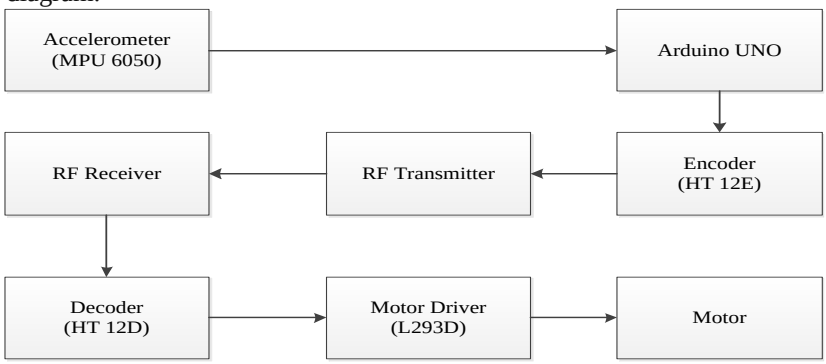

Fig. 1.1: *Block Diagram of Gesture Controlled Vehicle*

The circuit diagram of transmitter (Figure 1) and receiver (Figure 2) [1] of the gesture-controlled vehicle is described below:

a) Transmitter: It sends data to the RF 434 TX module in the form of voltage levels, which are fed into the SDA and SCL pins of the Arduino UNO, which calculates the gesture movements of the hand and determines the data to be conveyed.

b) Receiver: The data pin generates the serial data received at the receiver (Rx434) and connects it to the decoder (HT 12D).

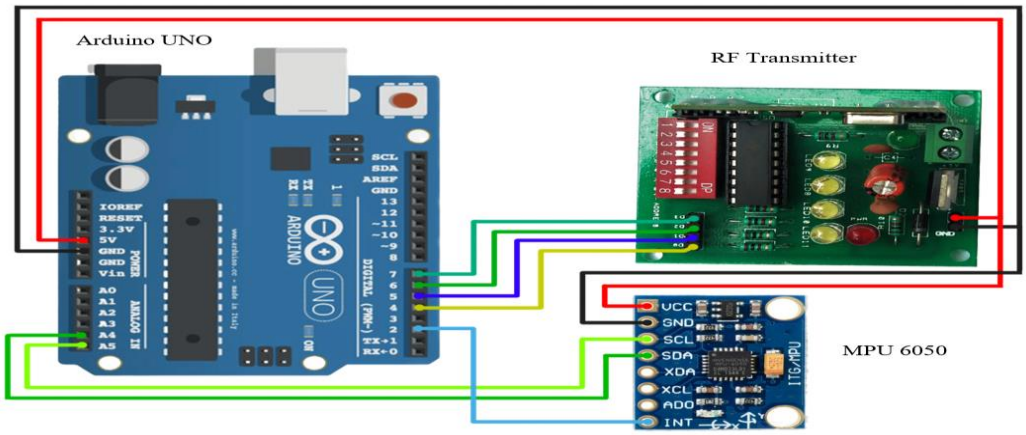

Fig.1.2: Circuit Diagram of Gesture Control Remote Module

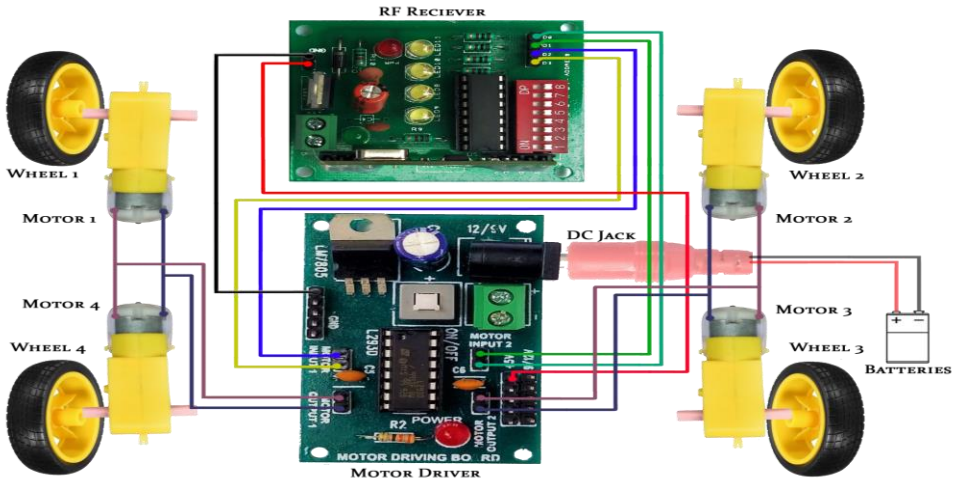

Fig.1.3: *Circuit Diagram of Gesture Control Robot*

The accelerometer, MPU 6050, was calibrated with the help of an Arduino UNO software. All of the conditions meeting the requirement of desired direction of movement have been calibrated, and the MPU 6050's X and Y directions will only be evaluated if the Z direction condition is met.

The values of four data pins on the Arduino UNO are set or reset based on the conditions found in MPU 6050. On the basis of the parameters the Arduino code is developed for desired movement of vehicle robot.

III. COMPONENTS OF GESTURE CONTROLLED VEHICLE

The entire system is split into two parts: the transmitter and receiver part [11]. The transmitter and receiver comprise of:

3.1 Accelerometer and Arduino UNO:

Because it can measure minute activities, the accelerometer is utilised as a sensing instrument. MPU 6050 is a six-DOF (degrees of freedom) accelerometer, which means it can output six values: three from the accelerometer and three from the gyroscope. However, the best accelerometer readings were used in this study. To reduce the mission's worth, the most efficient one microcontroller or controller was utilised. The Arduino UNO is utilised for the transmitter, while the RF module is used for data transmission. A three-axis accelerometer and three-axis gyroscope are included in the MPU6050. We can now measure acceleration, rotational displacement, and a range of other motion-related metrics using this method. To detect gestures, this will be connected to an Arduino UNO.

3.2 Encoder: With 212 encoders, the HT12E is an encoder-integrated circuit (IC). They'll be employed in far-flung managed device applications using the 212 series of decoders. It's primarily used to link RF and IR circuits together. The encoder/decoder pair should be compatible in terms of address range and data format. The address of encoder IC and decoder IC must be matched for secure and complete data transmission.

3.3 RF transmitter and receiver: A radio frequency module (RF module) is a typically tiny electrical device that transmits and receives radio signals between pieces of equipment. Wireless communication with all other tools in an embedded machine is frequently acceptable. Optical or radio frequency (RF) communication can be used to complete this wi-fi conversation.

3.4 Decoder: The HT12D is a decoder integrated circuit from the 212 family of decoders. Remote-controlled device programmes, including as burglar alarms, vehicle door controllers, and security systems, are commonly utilised with this type of decoder. It's designed to link RF and infrared circuits only.

3.5 Motor driver: The L293D is a circuit that incorporates two H-bridge motor driving forces (IC). Motor drivers act like modern amplifiers because they take a low-today-day manipulating signal and provide a better-today-day signal. The automobiles are driven by this superior cutting-edge indication.
Two H-bridge driving force circuits are included into the L293D. DC motors can be pushed forward and backward at the same time in their most common mode of operation. Common sense can be entered at pins 2 and 7, as well as pins 10 and 15, to control vehicle motor operations.

3.6 Gear Motors: A gear motor is an electric motor with a low horsepower or low speed output that is designed to create high torque. Geared vehicles come in a range of shapes and sizes, and they're probably likely used in a variety of household gadgets. Can openers, storage door openers, washing machines, time manipulation knobs, and even electric driven alarm clocks all use gear motors. Clinic beds, business jacks, and cranes are all common commercial programmes for a tools motor. They all work in the same way, regardless of the type of tool motor you're working with. When a system is necessary to apply an excessive amount of pressure in order to circulate a very heavy object, gear cars are widely used in commercial packages.

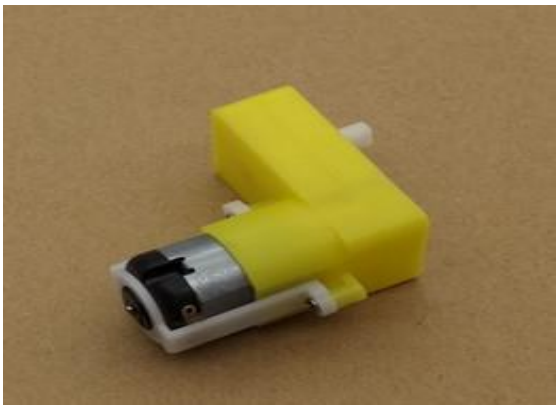

Fig.1.4: *DC Gear Motor*

IV. RESULTS AND DISCUSSIONS

It is observed from the results obtained that with acceleration orientation of +y, -y, -x and +x, the vehicle is taking the direction forward, reverse, left and right respectively and when the vehicle is required to be stopped, the accelerometer orientation needs to be at rest.
It is also observed that the five positions of hand are exactly matched with the directions of movement of vehicle.

V. CONCLUSION

The primary goal of this work was to create a vehicle that could run utilising hand movements captured by the Accelerometer MPU 6050 and wireless RF connection. An Arduino UNO R3 was utilised as a microcontroller for this project. The vehicle makes the appropriate movements for the pre-programmed and calibrated hand signals. With the help of the accelerometer, data from hand motions is supplied into the Encoder HT 12E via the Arduino UNO, and the values

are then communicated via Tx 434. The values are received by Rx 434 and decoded by a Decoder HT 12D before being transmitted to the motor driving component L293D. The information collected from the component operating the motor is then used to control these motors. The limitations of the current work, such as the small battery and limited range of operation of the RF module, could be overcome in the future by employing more powerful batteries and a GSM module for wi-fi signal transmission. A camera can also be mounted on the vehicle to monitor its movement.
The accelerometer of mobile phone can also be used for controlling the movement of the vehicle which will reduce the hardware cost of the project and will give basic understanding of interfacing technology tools with vehicles.

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