HAND CONTROLLER ROBOT

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Introduction to Electrical-Electronics Engineering Project Report

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CONTENTS

ABSTRACT

Unmanned ground vehicles have always been the tools that make life easier and minimize the risk of injury. This is because they can be controlled remotely. For example, the bad results of the war can be minimized by sending this vehicle to a dangerous war zone with wireless control and pre-scanning. User sends the robot to dangerous areas by controlling in an environment where s/he feels safe. They also communicate with transmitting and receiving radio waves. The transmitter transmits the commands of the sensors to the robot (receiver) and executes the robot commands. In this study, communication is provided with NRF24L01 modules. The transmitter also has the mpu6050 sensor. Commands are sent to the robot according to the status of this sensor. In this way, the pilot can control the robot wirelessly with the transmitter module connected to his hand.

Keywords: UGV, autonomous, hand controller, NRF24L01, MVU6050

1. INTRODUCTION

Unmanned ground vehicle (UGV) is a vehicle that operates in contact with the ground and without a human presence inside. UGV is used in many places where it may be inconvenient, dangerous or impossible for a person to be present. Usually, the vehicle will have a set of sensors to observe the environment, and will either autonomously make decisions about its behavior or transfer data to a human operator at a different location who will control the vehicle through teleoperation. UGV is the land-based equivalent of unmanned aerial vehicles and underwater vehicles.[1]

The word autonomous was first described by Aristotle as "If every vehicle could do its job, if the shuttle could weave itself without the need for human hands, the managers would not need staff."[2] This phrase is also the basis of UGVs. With autonomous vehicles, everything can be controlled more conveniently and securely and requires less workload. Francis Houdini's development of an automobile powered by radio waves in 1925 can be given as an example of the first work in this field.[3] The first fully autonomous unmanned ground vehicle study can be described as Shakey. Shakey is a test robot developed in the 1960s by Charles Rosen and a group of engineers at the Stanford Institute using artificial intelligence.[4]

One of the most important features of UGVs is that it minimizes injuries in the defense industry. For example, a mine area can be controlled remotely to clear the mine area. One of these remote (wireless) control methods is communication with radio waves. The transmitter device at the control point is controlled by sending remote instructions to the receiving device in the UGV. NRF24L01 is an example of these radio communication devices. In order to control the vehicle, this device must be in both the receiver and the transmitter.

In this study, wireless communication is used to communicate with the receiver and transmitter. Instructions have been sent to the robot based on the status of the acceleration sensor. AT the second part of the study,the proposed method and component list is given, application details are explained at the third part and at the last part the results are given and future stustudies are mentioned.

2. METHODOLOGY

In this study, the NRF24L01 modules were communicated to transmit commands to the robot according to the status of the mvu 6050. This 3 axis gyro and 3 axis angular accelerometer determines the rotation direction and speed by comparing the angular ratios of the axes of a fixed object.[5] When the acceleration sensor tilts to the right, the right motor goes forward left motor backward and the right led flashes. When acceleration sensor tilts left, left motor goes forward, right motor goes backward and the left led flashes. When the sensor is tilted forward, the motors go forward and both leds turn on. As the angle of inclination made by the mpu 6050 increases, the rotation speed of the motors increases. Motors do not move when the acceleration sensor is in balance position. Flowchart and block diagram give information about this study in Figure 1 and Figure 2.

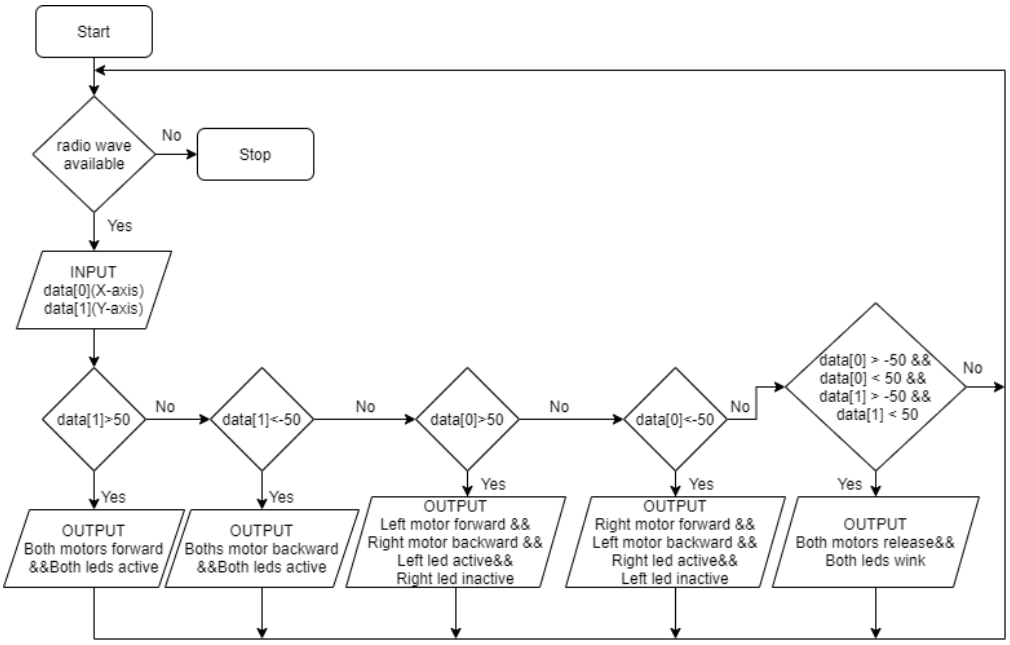

Figure 1. Flowchart of the system

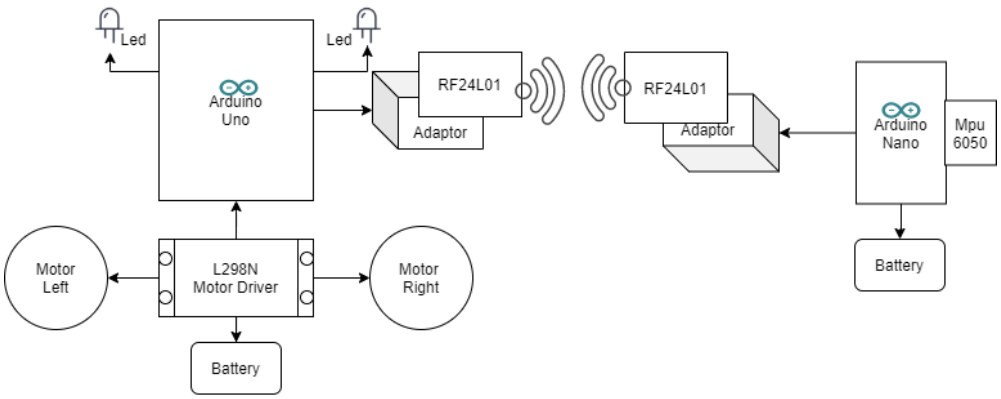

Figure 2. Block Diagram Of The Syste

Information about the components used in the system is given in the following section.

2.1 Arduino Uno/Nano

Arduino is an electronic platform based on hardware and software that can be used in many projects. The boards to be used in the proposed method is the ATmega328P microcontroller based nano model given in to the left of Figure 3 and the Atmega 328 microcontroller based uno model given in to the right of Figure3. [6][7]

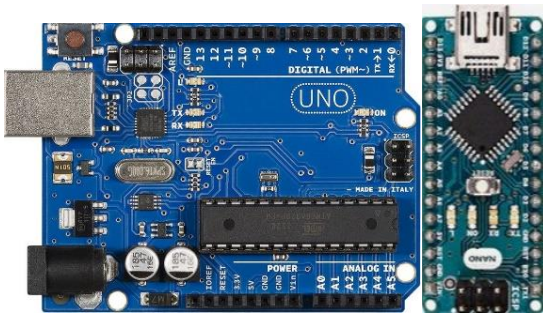

Figure 3. Arduino Uno and Arduino Nano

Some important features of Arduino Uno and Arduino Nano are given in Table 1.

Table 1. Some Features of Arduino Uno/Nano [6][7]

Microcontroller	Atmega 328P/328	**Analog Input Pins**	6/8
Operating Voltage	5V/5V	**Clock Speed**	16 MHz/16MHz
Digital I/O Pins	14/22	**DC Current per I/O Pin**	20 mA/ 40mA
Input Voltage	6-20V/7-12 V	**PCB Size**	53.4 x 68.6 mm/18x45 mm

2.2 Nrf24L01 + Adaptor Modul

Nrf24L01 module can perform many functions such as wireless communication of two or more Arduino boards with each other, data transfer, robot control. The NRF24L01 wireless module transmits and receives data at a specific frequency called a channel. Also, in order for two or more transceiver modules to communicate with each other, they must be on the same channel. This channel can be any frequency in the 2.4 GHz ISM band, or to be more precise, it can be between 2.400 and 2.525 GHz (2400 to 2525 MHz).[8] Nrf24L01 may have problems working with 3.3 volts and there may be interference and can be used with the help of the adapter at the bottom of Figure 4 to eliminate them.

Figure 4. NRF24L01+Adaptor Modul

2.3 MPU 6050

Mpu 6050 is an acceleration and gyroscope sensor used in aircraft, balance robots and remote-controlled devices such as UAVs and UGVs. It is an IMU sensor board with 3-axis gyro and 3-axis angular accelerometer. Since it has a voltage regulator on it, it is supplied with voltage between 3v and 5v. The ratio of the value measured from the accelerometer to the value measured at 90 degrees gives us the sine of the angle made in the X axis. sin (αx) = will be the measured g value / the maximum measurable g value.[9] Euler Angle calculation can be used for more accurate angle calculation. The angles made on the X and Y axis according to this calculation are:

$$AngleY = atan\left(\frac{X}{\sqrt{Y^2+Z^2}}\right) \quad (1) \qquad AngleX = \text{atan}\left(\frac{Y}{\sqrt{X^2+Z^2}}\right) \quad (2)$$

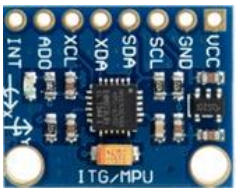

Figure 5. MPU 6050

2.4 Motors and Motor Driver (L298N)

With Arduino, the DC motor can go forward or backward and its rotation speed can be adjusted. The current supplied to the motors from the Arduino is not sufficient to run the motors. Therefore, dc motors are used with a motor driver. The L298N module in the middle of Figure 5 is an example of a motor drive.[10]

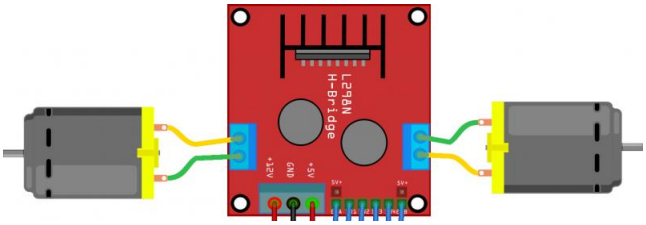

Figure 6. Motors ans Motor Driver

2.5 Other Materials

LED, switch, battery and breadboard are also used in this study. Led has two legs, anode and cathode. The anode leg corresponds to the + pole and the cathode leg to the - pole. Cathode - its leg is connected to GND (ground line) in our circuit.[11] It has two states, open or closed. There is electricity transmission in the closed state, no electricity transmission in the open state. Devices that directly convert chemical energy into electrical energy and store it within are called batteries.[12] In this study, 6 batteries of 1.5 volt are used in the receiver and one 9-volt battery are used in the transmitter. Breadboard allows easy testing of established circuits without soldering to each other.

3. EXPERIMENTAL RESULTS

In this study, firstly, the motors is connected to the driver and the driver to the Arduino. NRF24L01 module is connected to Arduino and turned into receiver position. NRF24L01 at the transmitter position is connected to the arduino. The MPU6050 sensor is connected to the transmitter. The codes is uploaded to the Arduino's. Power connections is made to the circuits. The robot is moved by sending information to the robot (receiver) according to the position of the MPU650. There was a communication problem with this source NRF24 modules. This trouble was solved using the NRF24L01 Module Adapter. Camera is tried to be used in this project. Image transfer was provided from the OV7670 camera via PC, but its use was abandoned because the camera module could not be connected wirelessly. The design of the system is shown in Figure 7.

Figure 7. System Design

4. CONCLUSION

The general name of the vehicles in contact with the ground that can be controlled from a wireless control point without a human presence is called unmanned ground vehicle. In this study, it is learned how to communicate arduinos with Nrf24 modules. It was learned how to move a vehicle by transmitting commands to the vehicle according to the situation of the Mpu6050. During the project, practicality is gained in subjects such as soldering and writing code. Camera usage is learned, but could not be added to the project due to wireless usage. This work can be developed in the future to provide image transfer via wireless connection by installing a camera.

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