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Robotic Hand Gesture System With GSM and Camera Control

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ABSTRACT: The objective of the proposed model is to promulgate the wheelchair direction regulation with hand gesture recognition. It is helpful for differently-abled people, who can control their vehicle direction. The system is categorized into gesture unit (Transmitter), wheelchair unit (Receiver), and GSM alert system and Camera control. This wheelchair movement can be commanded by simple hand gestures. It consists of an Accelerometer sensor that controls the wheelchair direction through hand gestures given by the users. Using Arduino, values from the sensor are monitored and accordingly the direction changes. Based on the direction of the Acceleration, Arduino controls the wheelchair ways like Right, Left, Backward, & Forward. Additionally, this system is provided with a camera module, to access the vehicle from the user's location. It also provides an emergency alert system by means of Global system for mobile communication module.

KEYWORDS: Gesture, Arduino, Global System for Mobile Communication, Wi-Fi.

I. INTRODUCTION

Elderly people or differently-abled people rely on other family members to move around their residence or within their surroundings. In earlier systems wheelchair had circumscribed range. Due to this, we were unable to handle the wheelchair from a distance. The wheelchair is capable of manual action. Manually the direction is guided using a joystick. Traditional wheelchair consists of buttons, joystick to carry out various functions but a resourceful smartwheelchair would be a helpful aide for them. The modern advancement in various fields like industrialization (automation), artificial intelligence, robotics, embedded system; etc. can be combined together and utilized to customize such a wheelchair. The motorized wheelchair is wirelessly controlled by endorsing appropriate communication systems [3]. Substituting joystick with hand gesture we have improved the range of the proposed model. The wheelchair direction is controlled by hand gestures as required. The acquisition method is a technique used for hand gestures. The drawback of voice-controlled technologies is that the wheelchair gets oversized and it has to be controlled only by sitting on it [5]. The proposed design makes the wheelchair a lot simpler to convene and to handle; further, the manufacturing cost has also economized.

II. Literature Survey

Ample analysis has been already carried out in the area of controlling thevehicle's direction using Homo sapiens motion as communication, MEMS Accelerometer sensor is used to identify the tilt and change in direction of the wheelchair as directed is a novel idea [4]. Several additional features have been combined to control the wheelchair along with voice recognition. In the earlier analysis, only X and Y directions were taken into consideration [2]. Numerous machine learning and statistical methods could possibly be used for detecting and training human motions as communication [5][6]. Face tracking for pointing and scrolling control has been proposed by a few journalists and have stated being fruitful. In contradiction to eye ogling users are able to maintain the hand gestures at or below the level required to make fine positioning [4]. When correlated to eye ogling, hand gestures can be more factual while handling low-resolution images and can have control over a wide range. The earlier design used the ARM7 controller for controlling the wheelchair movements [3].Debugging is difficult in ARM7 which a major drawback. The proposed system uses Arduino hence the program can be

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modified as and when required. The proposed system is based on hand gestures, equips a wireless control. This system can be easily operated and economical i.e. easily affordable by all.

III. Hardware Components

- **Arduino Uno**is an open source microcontroller board based on the Microchip ATme328P Microcontroller. Arduino is powered using external 9-volt battery or by an USB cable, though the voltages can be varied between 7 volt and 20 volt. Arduino transfers data to the computer, microcontrollers or Arduino board. The Arduino Uno is loaded with programs for performing various operations.
- **GY-61 DXL335 3-axis accelerometer module** is based on the ADXL335 integrated circuit. ADXL335 is powered using an on-board 3.3V voltage regulator. The power provided to the module should range between 3.3V to 6V DC. The full sensing range of the sensor is +/-3g. Capable of measuring both dynamic and static acceleration. Therefore it can sense the direction of the command given by the user.
- **Motor Drive (L293D)** uses the same IC to drive 2 DC motors. The IC works on the principle of Half H-Bridge.Both speed and direction control is possible. The direction of these two motors can be controlled independently. The motor voltage to Vcc2 (Vs) ranges from 4.5 volts to 36 volts. The Maximum Peak Current of the motor is 1.2A and 600mA is the maximum continuous motor current. The supply voltage to Vcc1 (Vss) ranges from 4.5V to 7V. It has an additional feature of thermal shutdown.
- **OV7670 Camera Chip** is a low- voltage CMOS image sensor that provides the complete use of a single-chip VGA camera and image processor in a small footprint package. It has highly sensitive for poorly lit operation. This is placed in the receiver unit to acknowledge and capture the live action of the surrounding.
- **RF Module (433 MHz)**is a wireless simplex receiver and transmitter. The operating voltage of the receiver ranges from 3V to 12V and the operating current is 5.5mA. The transmission distance ranges between 3m (without antenna) and can be extended up to 100m. Amplitude shift keying is used as a modulating technique.The module itself cannot work on its own; it requires some kind of encoding before being transmitter and decoding after being received; so it has to be used with an encoder IC (HT12E) or decoder IC (HT12D) or with any microcontroller on both ends.
- **ESP8266 Wi-Fi Module** is an integrated TCP/IP protocol stack with self-reliant SOC which provides any microcontroller to access your Wi-Fi network. Wi-Fi module is capable of on-board storage and processing which integrates it to the sensors and various application- specific devices through GPIOs with basic development up-front and nominal loading during runtime. Power down leakage current is less than 10μA. It providesinternet connectivity; it can work both as a Station (can connect to Wi-Fi) and as an Access point (can create hotspot) hence it can easily retrieve data.
- **GSM module SIM800A**it can transmit Voice, SMS and data information with low power utilization. It facilitates remote data monitor and control. Quad-band ranges from 800 to 1900MHz. Input voltage can be manipulated between 9-12V.
- **Power Supply**istapped from a 12V battery; using voltage regulator (7805) 12V is converted into 5V as the designed circuit will work in 5v dc only.

IV. System Work Flow:

1.1 Transmitter Unit:

The transmitter unit contains GY 61 accelerometer, RF transmitter module and some more integrated chips like encoder (HT12E), Operational amplifier. It converts the analog signal from accelerometer in digital form to encoder IC. Output data from the encoder will send to RF transmitter module for transmitting the data to receiver unit wirelessly.

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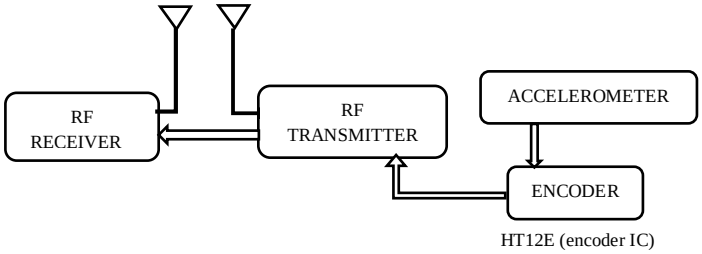

Figure 1. Transmitter Unit

4.2 Receiver Unit:

The receiver unit contains RF receiver module which receives data from transmitter unit. The transmitted data is sent to decoder IC (HT12D) for decoding. Output data (decoded data) from the decoder is sent to Arduino Uno. Depending upon the information Arduino will drive the motor and the wheelchair will rotate in the direction of hand gesture. The Arduino Uno is powered by 5V tapped from the 12V battery source. The direction of the wheel changes in response to the motion of hand. In addition to hand gesture we have a camera module (OV7670) and GSM module (SIM800A) in receiver unit. The OV7670 camera chip is usedto capturethe live action; the images obtained or viewed through the camera chip are sent to mobile application using Wi-Fi module ESP8266.The GSM module is used to send SOS during critical or emergency situations. The Arduino Uno is programmed based on users requirements hence can be manipulated later depending on the future demands.

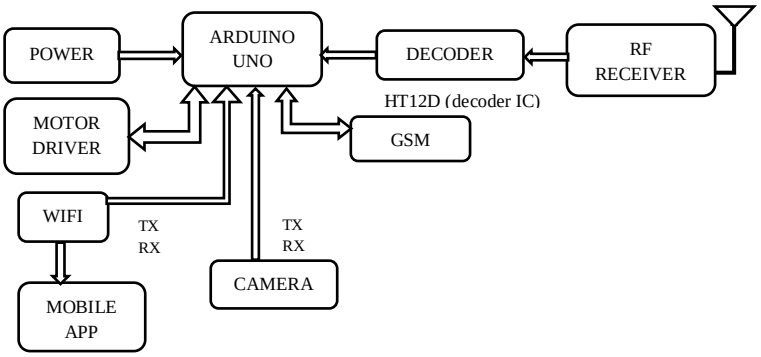

Figure 2. Receiver Unit

2. Software Result:

The output (figure3) of Wi-Fi controlled motor motions by using an android device can be seen in the serial monitor of the Arduino IDE software.

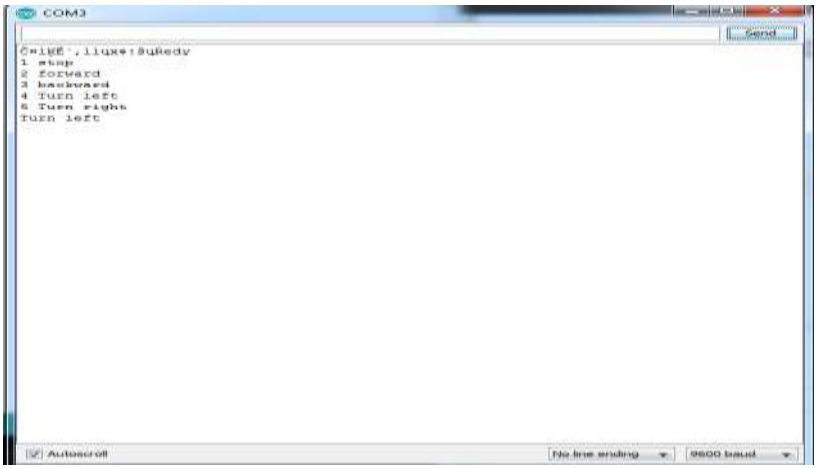

Figure 3.Output

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3. Proposed System:

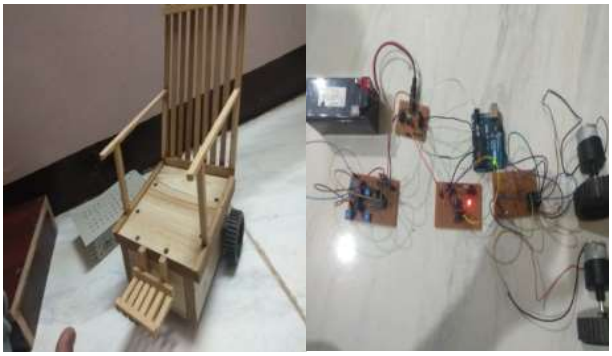

Figure 4. Proposed Model

V. Future Work

The programmed Arduino can be reprogrammed based on the users demand. Additionally the health of the individual can be frequently monitored and a timely report can be sent to relatives; using which necessary action can be taken prior hand.

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