International Journal of Electronics and Communication Engineering (IJECE)
ISSN (P): 2278–9901; ISSN (E): 2278–991X
Vol. 11, Issue 1, Jan–Jun 2022; 11–16

International Academy of Science, Engineering and Technology
Connecting Researchers; Nurturing Innovations

IMPLEMENTATION OF MEMS BASED HAND GESTURED ROBO ARM USING WIRELESS TECHNOLOGY

G.V. Harshini, T Sampath, Bhargav Chowdary & N. Jyothi

Research Scholar, Department of Electrical, Electronics and Communication Engineering, GITAM Deemed to be University, Visakhapatnam, India

ABSTRACT

In contrast to switches or keypads, the robustness of MEMS-based Gesture Controlled Robot refers to a robot's ability to be controlled by hand gestures. Some future robots may be able to interact with humans more naturally. As a result, we are concentrating on gesture interfaces that are based on hand motion. This was accomplished using a MEMS sensor and an Ultrasonic sensor for confirmation. A programme was written and executed on a microcontroller to satisfy our needs. Considering the results of the testing reveal that our gesture formula is incredibly competent and that it also boosts the natural style of intelligence.

KEYWORDS: *Robustness of MEMS, MEMS Sensor, Natural Style of Intelligence*

Article History

Received: *30 Mar 2022* **|** ***Revised:*** *05 Apr 2022* **|** ***Accepted:*** *07 Apr 2022*

INTRODUCTION

When science and technology are applied to industry, they're known as technology. There can be no justification for technological development unless it is employed to benefit the user. In today's society, technology is used to execute various jobs of varying complexity. Science and technology have a profound effect on society as a whole. The advancement of technology has profoundly impacted our way of life. There are several ways to accomplish this, including applying complicated logic to automate multiple tedious procedures. Human-computer interaction and image processing are among the numerous research areas that have focused on the study of gesture recognition. User interface technology has become more significant because of the rise in human-machine interactions in our everyday lives. With physical gestures as intuitive expressions, people can control computers and robots more easily. Robots may now be controlled wirelessly, through a cell phone, or with a direct-wired connection via remote or cell phone. If we consider the cost and hardware requirements, the complexity of low-level applications rises significantly. Remotely controllable slave robots have been shown to follow their master's hand movements, for example, in telerobotic [1].

Gestures of command Human nonverbal communication rely heavily on robots. "Stop" and "victory" gestures, as well as simple cardinal information (such as "two"), may be conveyed with these gestures. A real-time continuous gesture recognition system for sign language Face and Gesture Recognition in the absence of traffic lights may also be used to communicate with deaf individuals and police officers.

Arming and deploying autonomous vehicles, such as robots, into hostile environments is becoming more common in military operations. Undercover or dangerous operations may exclude the use of conventional controls to manage robotic systems. These severe settings need the help of a wireless data glove, which was created to facilitate communication.

To control a military robot, this study reports on the adaption of a communications glove. In recent years, the development of novel remote-control methods for robots has been a major focus of research and development. Wearable and wireless teleoperation systems have been designed to operate robots with several display modes, as an illustration. There have been instances when remote-controlled robots have been utilised when human safety is at risk. Gestures controlled a replica of a flying manta ray.

Robotic technology was employed to drive a wheelchair-using glove gear. Character identification in 3-D space using inertial sensors [2] and [3], gesture recognition to operate a television set remotely [4-7] and allowing a hand as a 3-D mouse [8-10] are some of the other suggested uses of hand gestures. Moreover, it may be utilised to enhance interpersonal relations. In our research, we've developed a small 3-D hand gesture detection system based on a MEMS accelerometer. The technology has a variety of possible applications, including serving as a vocal track for those who are unable to speak [11].

There may be unexpected optical noise, slower dynamic response, and significant data collection/processing times when using vision-based methods. To solve these issues and balance accuracy and cost, a micro inertial measurement unit (MIMO) is used in this study to detect hand accelerations in 3D. In order to build the suggested recognition system, MEMS acceleration sensors are used. Our present system uses MEMS accelerometers exclusively, and gyroscopes are not employed for motion detection because of the enormous computational load they would impose.

IMPLEMENTATION OF ROBOT

Software Implementation

To run the programme, embedded c code is used to write user application instructions. Application software source code is saved as a.hex file when the compiler is used. Dumping is done using a micro flash programmer. Microcontroller ROM is used to store software on the microcontroller device. Vision3's menu bar, toolbar and windows for displaying source files, conversation boxes and information allow us to perform tasks fast. At the same time, it lets us explore and evaluate many source files in Vision3.

In order to build an application, a project contains all of the information necessary to create the binary code from the source files. Due to the significant degree of customisation required, the tools must offer a high degree of flexibility. When the app is built, these settings are kept in a project file, so they don't have to be entered again. As soon as you load a project file into KEIL, KEIL immediately understands which source files you'll need, where to locate them, and how to set up your tools. "Projects" are the primary focus of KEIL's users. All the source files and tool settings required to build an application, as well as —if necessary – the way the programme is to be imitated, are listed in an application project. Once the project is complete, you may save it and all of its settings in a single location. All the appropriate windows are shown when the project is reloaded and the simulator or debugger is launched. The extension is used to store files containing KEIL projects.

Hardware Implementation

A gesture is a nonverbal bodily activity that is more accessible than speaking. This may be done using a sensor that reads gestures. A source of electrical power is referred to as a power supply. A power supply unit (also known as a PSU) is a device or system that provides electricity or other energy to an output load or set of limitations. Typically, electrical energy sources are referred to as "power sources," whereas mechanical power sources are referred to as "power sources," and so on. Low power, low profile capacitive micro machined accelerometer, **Max232**, has signal conditioning and a 1-pole low pass filter with temperature adjustment, self-test, 0g Detect, which detects linear freefall and g-Select, which allows for the choosing between 2 sensitivities. There are no extra devices required for zero-g offset or sensitivity. Battery-powered gadgets may make use of the **Max232's** Sleep Mode.

The RF module makes use of Radio Frequency technology, as implied by its name. The frequency range is between 30 kHz and 300 GHz. In this RF system, variations in carrier wave amplitude encode digital information. This modulation is known as "Amplified Shift Keying" (ASK). Radiofrequency transmission is superior to infrared communication for a number of reasons. Since radio frequency (RF) is able to travel across larger distances, it is useful for long-distance applications. A physical barrier between a transmitter and receiver does not stop radio-frequency (RF) waves from propagating. Radio-frequency (RF) transmission, on the other hand, is more powerful and reliable. RF communication needs a specific frequency compared to IR communication, which might be affected by other IR emitting devices.

The HT 12E encoder IC is a CMOS encoder for remote control systems. They can encode 12-bit information, including N address and 12-N data. Bonded out, each address/data input may be programmed outside. The HT 12D is a series of remote-control microcontrollers based on CMOS technology. This is how ICs are connected. Encoding and decoding must be performed by a pair of devices with an equal number of addresses and data formats to ensure proper operation.

An RF transmission channel is utilised to transfer the serial address and data from the matched decoder to the output pins of the Decoder after processing on the decoder. These devices provide drivers for four high-current half-H outputs. When used in a bidirectional fashion, the L293 can generate up to 1 A of driving current at voltages ranging from 4.5 V to 36 V. It can provide bidirectional currents of up to 600 mA when supplied with a supply voltage of between 4.5 and 36 volts. Relays, solenoids, dc and bipolar stepping motors and other high-current/high-voltage inductive loads may be powered by both devices in positive supply applications.

A GSM modem is a remote modem that associates with a GSM network by means of radiofrequency transmission. A remote modem’s capacity is similar way as a dial-up modem does Not at all like dial-up modems, remote modems send and get information by radio waves, while dial-up modems communicate and get information over a proper phone line.

TRANSMITTER SECTION

The transmitting part is shown in the picture below, which contains an accelerometer whose output is in continuous form since the encoder can only comprehend digital data. The transmitting section also includes an encoder that can only understand digital data. The analogue to digital conversion is accomplished via the employment of a comparator, and because the digital data must be transferred, we employ a radio transmitter to broadcast the serial data that the encoder has converted from the parallel data generated by the encoder.

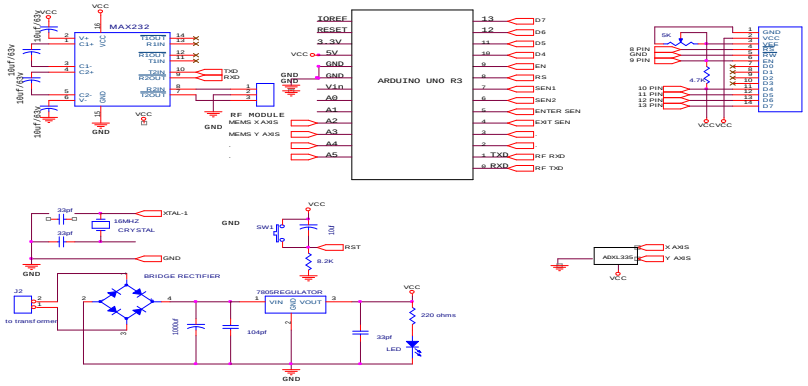


Figure 1: Circuit Diagram of the Transmitter Section.

RECEIVER SECTION

The recipient part is displayed in the getting block graph displayed previously. As per the information communicated by the transmitter, it is gotten by the RF recipient, and the sequential information is given as contribution to the decoder, which changes the sequential information over to resemble information and gives it as contribution to the microcontroller, which comprises of a predefined program to get done with our responsibility, and the regulator, contingent upon the information got, creates signs to the engine driver, LEDs, bells, and different gadgets. It utilizes various modules, like the ping and GSM modules. The result signal from the ultrasonic sensor is shipped off the microcontroller, which is executing an appropriate implanted 'c' program on the microcontroller.

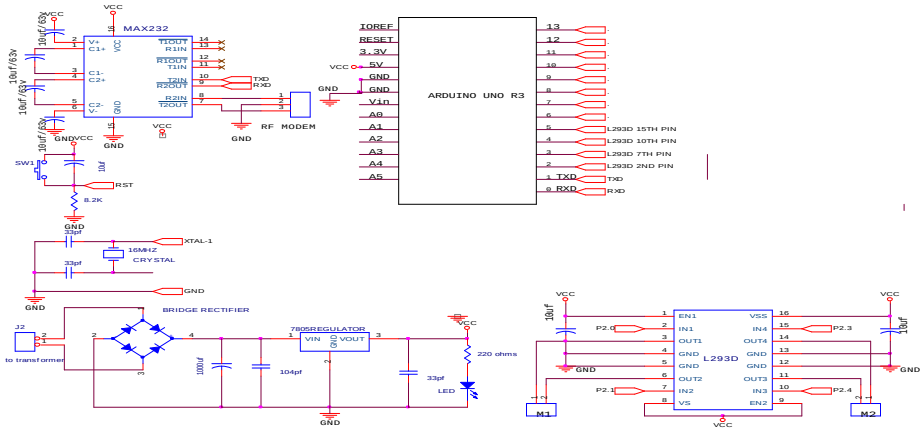
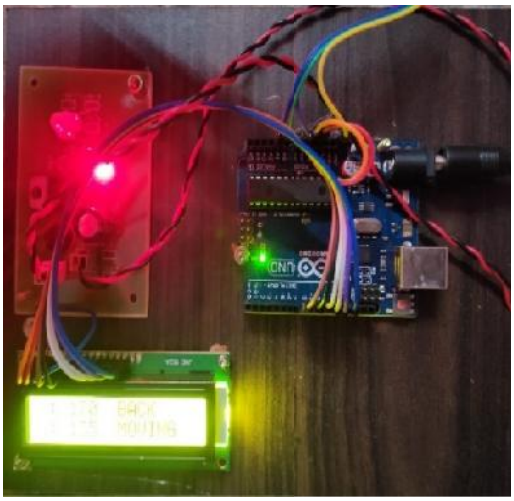


Figure 2: Circuit Diagram of Receiver Section and Arduino Pin Diagram.

RESULTS

Many pieces of equipment, such as those used in the field of safety require users to place both hands on a control switch before the controller may take any action at all. Instead of forcing operators to move their hands to specific buttons, why not just enable them to raise their hands in front of a gesture sensor as an alternative. These transmitting and receiver section are fabricated and are shown in following figures. The result of four movements like front, back, left and right movements are shown in figures 3 to 6. This kind of control can enhance output when used properly while simultaneously decreasing the negative repercussions of repetitive operations and improving safety and these movements are shown in figure7. Hand gestures are the only way advanced robotic arms, designed to replicate the human hand, can be easily controlled and manoeuvred. The arm controller will wear a pair of sensor gloves, and the robotic arm will move in time with the controller's every motion.



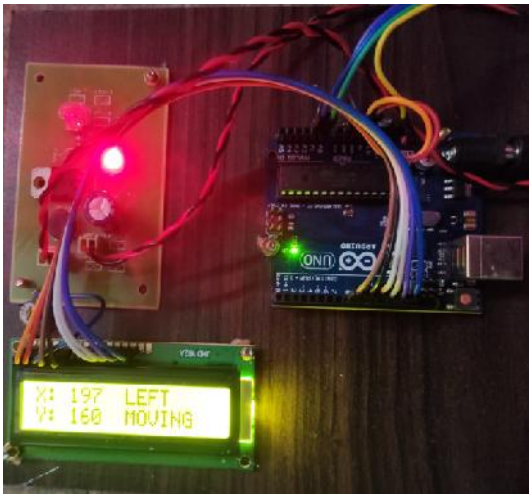
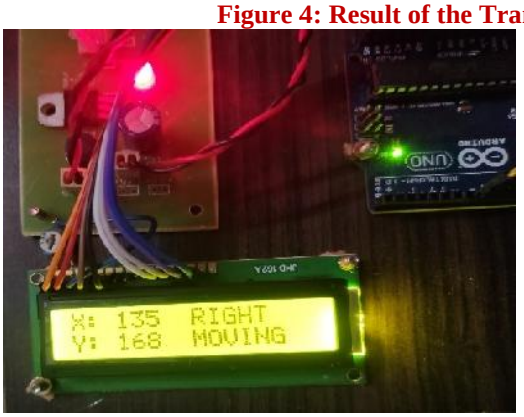


Figure 3: Result of the Transmitter Showing Backward Signal.

Figure 4: Result of the Transmitter Showing Left Signal.



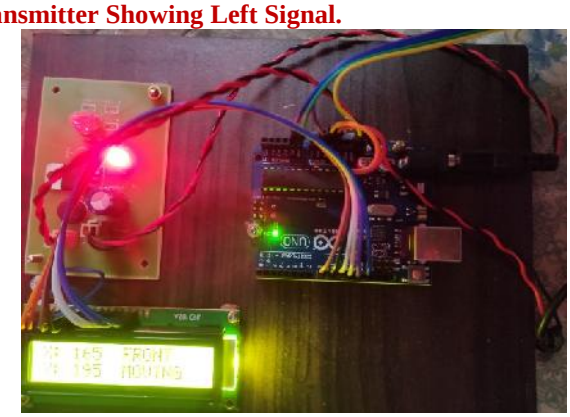


Figure 5: Result of the Transmitter Showing Right Signal.

Figure 6: Result of the Transmitter Showing Forward Signal.

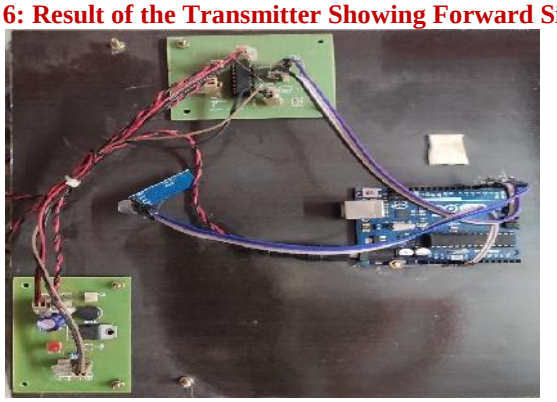


Figure 7: Receiver Section.

CONCLUSIONS

A quick and simple algorithm for hand gesture detection for commanding robots is developed and tested. The efficiency of this method on actual photos, and the results seem promising. In this approach for controlling robots using gestures, we have only explored a restricted number of actions. There are several methods to broaden the scope of our algorithm so that it can identify a wider range of movements. In order for our algorithm to be deployed in demanding operating settings, we would need to significantly increase the gesture recognition element of our algorithm. Occlusions, temporal tracking for detecting dynamic motions, and 3D modelling of the hand are still well beyond the present state of the art when it comes to

reliable hand gesture identification. Advanced robotic arms, such as these, can execute complex and sometimes hazardous tasks with relative ease and are becoming more popular. Construction, hazardous waste disposal, and medical sciences are just a few fields where this technology might be used in the future.

REFERENCES

1. *T. H. Speeter (1992), "Transformation human hand motion for tele manipulation," Presence, 1, 1, pp. 63–79.*
2. *Y. Masuda, M. Sekimoto, M. Nambu, Y. Higashi, T. Fujimoto, K. Chihara, and Y. Tamura, "An unconstrained monitoring system for home rehabilitation," IEEE Eng. Med. Biol. Mag., vol. 24, no. 4, pp. 43–47, Jul./Aug. 2005*
3. *S. Zhou, Z. Dong, W. J. Li, and C. P. Kwong (2008), "Hand-written character recognition using MEMS motion-sensing technology," in Proc. IEEE/ASME Int. Conf. Advanced Intelligent Mechatronics, pp.1418–1423.*
4. *J. K. Oh, S. J. Cho, and W. C. Bang et al. (2004), "Inertial sensor based recognition of 3-D character gestures with an ensemble of classifiers," presented at the 9th Int. Workshop on Frontiers in Handwriting Recognition.*
5. *W. T. Freeman and C. D. Weissman (1995), "TV control by hand gestures", presented at the IEEE Int. Workshop on Automatic Face and Gesture Recognition, Zurich, Switzerland.*
6. *L. Bretzner and T. Lindeberg(1998), "Relative orientation from extended sequences of sparse point and line correspondences using the affine trifocal tensor," in Proc. 5th Eur. Conf. Computer Vision, Berlin, Germany,1406, Lecture Notes in Computer Science, pp.141–157, Springer Verlag.*
7. *H. Je, J. Kim, and D. Kim (2007), "Hand gesture recognition to understand musical conducting action," presented at the IEEE Int. Conf. Robot &Human Interactive Communication.*
8. *T. Yang, Y. Xu, and A. (1994), Hidden Markov Model for Gesture Recognition, CMU-RI-TR94 10, Robotics Institute, Carnegie Mellon Univ., Pittsburgh, PA.*
9. *S. Zhou, Q. Shan, F. Fei, W. J. Li, C. P. Kwong, and C. K. Wu et al (2009)., "Gesture recognition for interactive controllers using MEMS motion sensors," in Proc. IEEE Int. Conf. Nano /Micro Engineered and Molecular Systems, pp. 935–940.*
10. *S. Zhang, C. Yuan, and V. Zhang (2008), "Handwritten character recognition using orientation quantization based on 3-D accelerometer," presented at the 5th Annu. Int. Conf. Ubiquitous Systems.*
11. *J. S. Lipscomb (1991), "A trainable gesture recognizer," Pattern. Recognit., 24, 9, pp. 895–907.*