

## Wireless Data Gloves Controlled Virtual Musical Instrument

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**Abstract**—In this paper we describe the Data Glove Controlled Virtual Musical Instruments. Traditionally musical instruments are very bulky and expensive to carrying it, whenever user wants to play it. Now the new system is generated which helps user to play musical instruments virtually, using data glove and computer system. The data glove is input device to the system which is made with the help of flex based register and which helps to tracking gesture made by user. These gestures are playing various musical instruments. Data glove produces the triggered signal which is receives by music generation system. This triggered signal used to play the predefined musical notes of instruments.

**Keywords**- Musical instruments, Data gloves, transceiver, Virtual Space.

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### I. INTRODUCTION

Music is an art of relation to create by medium of music that is sound. It is used by human being to make music. There are many ways to generated sound such as using bell, piano, guitar, drum, etc. The traditional musical instruments are expensive and bulky to carry it whenever user wishes to play it. In this paper data glove control virtual musical instrument is system develop for creating or playing a virtually different musical instrument. In this data glove is an interface between human and computer to recognize human gesture and generate the various sound or music using gestures made by user.

In data glove system main components are data gloves covered with stretch sensors, MIDI notes, musical generation system and data transceiver. The input is given to data glove controlled virtual musical system using data gloves covered with stretch sensors by performing the hand gestures. Data Glove is a device to interact with various computer systems. Consider a glove fitted with sensors and electrical wires hooked to a glove compatible computer. Here, we can move our hand inside the glove to generate the signal for computer. As we rotate or move our hand and manipulate our fingers, we can generate different types of signals to operate the computer.

The data gloves system uses receive signal from sensor gloves as input to the data gloves system. But before transmitting the input data to music generation system the data is process by signal conditioning system to map the sensor output into particular corresponding value which is transmitted

through transceiver to music generation system for matching the value with particular pre-define MIDI notes using matching algorithm.

Earlier attempts to make a system to play musical instruments virtually using data gloves include development of music glove by a musician Emogean Heap with a team of developers. This technology being new has been expensive and unknown for the basic users. Similar researches using various different techniques are in progress. Whereas the usage of data glove made of flex bend resistor, used in this paper, has helped researchers to develop a system to play various musical instruments by a single person at a comparatively reasonable price than pre-existing system [1].

### II. SYSTEM REQUIREMENTS

Our main objective is to generate musical notes of various musical instruments in accordance with the users hand gestures. The main components used for the same are the data glove, transceiver system and the music generation system. A data glove, a flex resistor based glove, is used to recognize the gestures made. This analog data generated by the data glove is recognized and translated by a microcontroller attached to the glove. The transceiver system transmits these signals from the microcontroller in the data glove to the system where music generation takes place. These signals are further used by music generation system to develop sound for music creation, using the pre stored MIDI notes of various musical instruments [1].

### III. SYSTEM IMPLEMENTATION

This section discusses about the system implementation and components of the data gloves controlled virtual musical instruments. The system made up of the following main blocks as, a data glove, signal conditioning system and the music generation system. Also describe the operational functioning of the whole system in detail.

#### A. Data Gloves

Data Glove is a device to interact with various computer systems. Consider a glove fitted with sensors and electrical wires hooked to a glove compatible computer. Here, we can move our hand inside the glove to generate the signal for computer. As we rotate or move our hand and manipulate our fingers, we can generate different types of signals to operate the computer.



**Fig.1. Data Glove**

Flex sensors are sensors that change in resistance depending on the amount of bend on the sensor. They convert the change in bend to electrical resistance the more the bend, the more the resistance value. Flex sensor work on 5v change in bend resist output voltage. The flex bend resistors, which is designed to give us value of the key pressed by the users in the virtual space. An un-flexed sensor has a nominal resistance of the order of 10KΩ. When the sensor is bent, its resistance goes on increasing gradually. The maximum amount of resistance is found to be around 160kΩ for a bending angle of 120°.

In this paper the input to the music generation system is generated from data glove component. The data gloves are interface between the user and the data glove control virtual musical instrument system. The gloves are wearing in the hand of the user. The flex sensor attached with data gloves are produce a signal after user bend his finger in real time, then the signal information is transmitted to the signal conditioning system for converting analog signal into digital signal.

The process value is send to microcontroller and then encoder IC to transmit signal through RF transmitter. The process value is received by music generation system, through RF receiver then sends to decoder IC and then microcontroller to perform the matching process and plays various musical MIDI notes and instruments as per user needs. The data gloves

are the inputs to the virtual musical instrument by wearing the gloves in hand and by making the various gestures. A particular gesture gives us the value which is used to play the unique musical MIDI note or also used to change instrument.

The developed data gloves has seven flex sensors, the system is developed on five finger music playing system. So five of them are mounted on right hand glove for used to make gestures and play the musical instrument and other two sensors are mounted on left hand glove are used to control the system. The purpose each flex sensor for each finger is as follows.

**Table I. Fingers functioning in data gloves.**

| Right Hand |                  | Left Hand |   |
|------------|------------------|-----------|---|
| Finger     | Function         | Finger    | Function                                  |
| Index      | Play Music Note. | Index     | Move Octave to play notes for right hand. |
| Middle     | Play Music Note. | Middle    | -   |
| Ring       | Play Music Note. | Ring      | -   |
| Little     | Play Music Note. | Little    | -   |
| Thumb      | Play Music Note. | Thumb     | Change Musical Instrument.                |

#### B. Music Generation System

The processed triggering data is forward to the music generation system from data gloves system through transceiver. Music generation system has an application program interface which performs the data matching process on received data with the predefined MIDI notes. Through the data matching process the corresponding musical notes are played.

The music generation system have some software and hardware components like matching algorithm, predefined MIDI notes, musical instruments and also sound generation system, AT89S52 microprocessor. Matching algorithm performs matching process on finger triggering data obtain from data gloves system with predefined musical MIDI notes in order to play musical instrument that are stored in music generation system.

At the system start, the user performs the gestures using data glove system, and then signals are processed and forwarded to the music generation system through transceiver. The processed data is a signal which is generated by flex sensors during gestures are analog signal converted into the corresponding digital signal. The process triggering data is received by music generation system in form of digital signal is map with a letters which are present in MIDI note table. Letter is used by matching algorithm for matching process of received letters with the letters that have been predefined in the application program interface. An appropriate musical MIDI note of corresponding octaves is played. as shown in table II in detail.

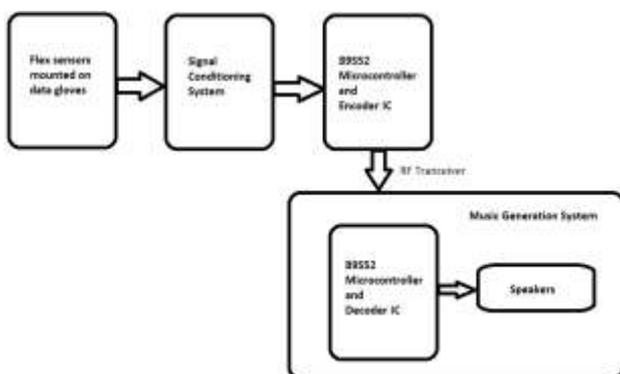
**Table II. Various MIDI notes**

| Octave No | Numbers for MIDI Note |    |    |    |     |     |     |     |     |     |     |     |
|-----------|-----------------------|----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|
|           | R                     | R# | S  | S# | T   | U   | U#  | V   | V#  | P   | P#  | Q   |
| -1        | 0                     | 1  | 2  | 3  | 4   | 5   | 6   | 7   | 8   | 9   | 10  | 11  |
| 0         | 12                    | 13 | 14 | 15 | 16  | 17  | 18  | 19  | 20  | 21  | 22  | 23  |
| 1         | 24                    | 25 | 26 | 27 | 28  | 29  | 30  | 31  | 32  | 33  | 34  | 35  |
| 2         | 36                    | 37 | 38 | 39 | 40  | 41  | 42  | 43  | 44  | 45  | 46  | 47  |
| 3         | 48                    | 49 | 50 | 51 | 52  | 53  | 54  | 55  | 56  | 57  | 58  | 59  |
| 4         | 60                    | 61 | 62 | 63 | 64  | 65  | 66  | 67  | 68  | 69  | 70  | 71  |
| 5         | 72                    | 73 | 74 | 75 | 76  | 77  | 78  | 79  | 80  | 81  | 82  | 83  |
| 6         | 84                    | 85 | 86 | 87 | 88  | 89  | 90  | 91  | 92  | 93  | 94  | 95  |
| 7         | 96                    | 97 | 98 | 99 | 100 | 101 | 102 | 103 | 104 | 105 | 106 | 107 |

The above table contains musical MIDI notes numbers which are arranged in table in eight rows and twelve column form. The column letters selected as per the user performs gestures of right hand and the octave number is change as the user triggers his left hand index finger then the combination of column and row particular MIDI note is played.

**IV. WORKING OF THE SYSTEM**

The block diagram of data glove controlled virtual musical instrument is shown in figure 4. The data glove system is working on 5v power supply. Data gloves are connected to the signal conditioning system via wires. Signal conditioning system convert the data gloves generated analog signal into digital signal and send to programmable microcontroller. The microcontroller 89S52 process signals and sends to music generation system via transceiver. The transceiver unit is used for unidirectional communication in between data gloves and music generation system to send trigged data. And triggered data is used by music generation system. Other hand music generation system microcontroller is programmed with application program interface for matching the received input with predefined musical MIDI notes. The matching algorithm does match the input triggering data with predefined musical MIDI notes and music instrument recognition and functioning.



**Fig.4. System Block Diagram**

The left hand data glove intended for control the system as per user perspective. The right hand data glove gestures are used to play musical instrument. Similarly left hand data glove is used to control the data glove system, with functions such as selection of the musical instruments and selection of octaves in which operator wants to play the musical instrument or corresponding notes.

**Algorithm:**

- Step 1 : Start.
- Step 2 : User wears the data glove and switch ON data glove system.
- Step 3 : User makes hand gestures as per he wants to play musical instrument.
- Step 4 : The generated triggering data is forwarded to signal conditioning system and analog signal is converted into digital.
- Step 5 : Digital triggering data is processed by programmable microcontroller and sent to music generation system through RF transmitter.
- Step 6 : The processed data will received by music generation system through RF receiver and processed by programmable microcontroller.
- Step 7 : The application programming interface compare the process data with pre-define MIDI notes by using matching algorithm.
- Step 8 : Matching algorithm select appropriate MIDI note from database to play particular octave of musical instrument.
- Step 9 : stop

**CONCLUSION**

In this paper, data gloves controlled virtual musical instrument system using flex sensors is an innovative idea for playing music virtual world is presented. Data glove controlled virtual musical instrument system is having the low cost with high degree of performance. Also it provides tremendous way to play music with different varieties in number of musical instrument. With this system musician assures feel of playing instrument in virtual world. It reduces the over head of carrying bulky and heavy computer keyboards. It requires only data gloves to control virtual musical instruments.

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