**Project name : Evolution of Human Communication Method from Vocal Signals Associated with Gesture to Syntactic Language**

**Domain : Embedded System**

**Microcontroller : AVR/ARM/PIC/MSP/Renesas**

**IEEE INSPEC Accessing Number**: **7686070**

Speech and gestures are the expressions, which are mostly used in communication between human beings. Learning of their use begins with the first years of life. In human communication, the use of speech and gestures is completely coordinated. Machine gesture and sign language recognition is about recognition of gestures and sign language using gloves. A number of hardware techniques are used for gathering information about body positioning; typically either image-based (using cameras, moving lights etc.) or device-based (using instrumented gloves, position trackers etc.), although hybrids are beginning to come about. However, getting the data is only the first step. The second step, that of recognizing the sign or gesture once it has been captured is much more challenging, especially in a continuous stream. In fact currently, this is the focus of the research.

The data is analyzed from an instrumented data glove for use in recognition of some signs and gestures. A system is developed for recognizing these signs and their conversion into speech. The results will show that despite the noise and accuracy constraints of the equipment, the reasonable accuracy rates have been achieved. The system objective was to develop a computerized Indian Sign Language (ISL) recognition system. The system considers only single handed gestures; therefore a subset of ISL has been selected for the implementation of BoltayHaath. The basic concept involves the use of computer interfaced data gloves worn by a disabled person who makes the signs. The computer analyses these gestures, minimizes the variations and synthesizes the sound for the corresponding word or letter for normal people to understand. The basic working of the project is depicted in the following figure. The below diagram clearly explains the scope and use of the BoltayHaath system. The system aims at bridging communication gaps between the dumb communities.

**The main objectives of the project are:**

1. To develop a computerized Indian Sign Language (ISL) recognition system.

**The major building blocks of the project are:**

1. Microcontrollers.
2. LCD with driver.
3. Flux sensor
4. Max232
5. Apr9600
6. Speaker
7. Regulated Power Supply.

**BLOCK DIAGRAM**

**AMPLIFIER**

**SPEAKER**

**FLUX**

**SENSOR**

**DIVIDER CKT**

**ADC**

**APR**

**9600**

**LCD**

**FLUX**

**SENSOR**

**DIVIDER CKT**

**ADC**

**CRYSTAL OSCILLATOR**

**RESET SWITCH**

**SATELITE CHANNEL**

**LCD**

**DRIVER**

**REGULATED POWER SUPPLY**

**MICRO CONTROLLER**

**Regulated Power Supply**

**5Vdc**

**Step down transformer**

**Rectifier**

**Filter**

**Regulator**

**Block Diagram Explanation**

1. **AVR Microcontroller**

The major heart of this project is microcontroller; a microcontroller (sometimes abbreviated µC, uC or MCU) is a small computer on a single [integrated circuit](http://en.wikipedia.org/wiki/Integrated_circuit) containing a processor core, memory, and programmable [input/output](http://en.wikipedia.org/wiki/Input/output) peripherals etc. However, compare to others microcontroller is fast and very ease to program in C language because of huge support can gain from the manufacturer for programming.

1. **LCD**

A liquid-crystal display (LCD) is a flat panel display, electronic visual display, or video display that uses the light modulating properties of liquid crystals. Liquid crystals do not emit light directly. They are common in consumer devices such as video players, gaming devices, clocks, watches, calculators, and telephones, and have replaced cathode ray tube (CRT) displays in most applications.

1. **APR 9600**

The APR9600 device offers true single-chip voice recording, on-volatile storage, and playback capability for 40 to 60 seconds. The device supports both random and sequential access of multiple messages. Sample rates are user-selectable, allowing designers to customize their design for unique quality and storage time needs. Integrated output amplifier, microphone amplifier, and AGC circuits greatly simplify system design. the device is ideal for use in portable voice recorders, toys, and many other consumer and industrial applications. PLUS integrated achieves these high levels of storage capability by using its proprietary analog/multilevel storage technology implemented in an advanced Flash non-volatile memory process, where each memory cell can store 256 voltage levels. This technology enables the APR9600 device to reproduce voice signals in their natural form. It eliminates the need for encoding and compression, which often introduce distortion.

1. **Flux Sensor**

In this project, the data glove is equipped with three bend or flex sensors, each of the bend sensor is meant to be fixed on one of the finger of the hand glove for the monitoring and sensing of static movements of the fingers of the hand. One side of the sensor is printed with a polymer ink that has conductive particles embedded in it. When the sensor is straight, the particles give the ink a resistance of about 30k Ohms. When the sensor is bent away from the ink, the conductive particles move further apart, increasing this resistance (to about 50k Ohms when the sensor is bent to 90º as in the diagram below). When the sensor straightens out again, the resistance returns to the original value. By measuring the resistance, you can determine how much the sensor is being bent.

1. **ADC**

An analog-to-digital converter (abbreviated ADC, A/D or A to D) is a device that converts a continuous physical quantity (usually voltage) to a digital number that represents the quantity's amplitude. The conversion involves [quantization](http://en.wikipedia.org/wiki/Quantization_%28signal_processing%29) of the input, so it necessarily introduces a small amount of error. Instead of doing a single conversion, an ADC often performs the conversions ("[samples](http://en.wikipedia.org/wiki/Sampling_%28signal_processing%29)" the input) periodically. The result is a sequence of digital values that have been converted from a continuous-time and continuous-amplitude [analog signal](http://en.wikipedia.org/wiki/Analog_signal) to a [discrete-time](http://en.wikipedia.org/wiki/Discrete-time) and discrete-amplitude [digital signal](http://en.wikipedia.org/wiki/Digital_signal).

An ADC is defined by its bandwidth (the range of frequencies it can measure) and its signal to noise ratio (how accurately it can measure a signal relative to the noise it introduces). The actual bandwidth of an ADC is characterized primarily by its [sampling rate](http://en.wikipedia.org/wiki/Sampling_rate), and to a lesser extent by how it handles errors such as [aliasing](http://en.wikipedia.org/wiki/Aliasing). The [dynamic range](http://en.wikipedia.org/wiki/Dynamic_range) of an ADC is influenced by many factors, including the resolution (the number of output levels it can [quantize](http://en.wikipedia.org/wiki/Quantization_%28signal_processing%29) a signal to), linearity and accuracy (how well the quantization levels match the true analog signal) and [jitter](http://en.wikipedia.org/wiki/Jitter) (small timing errors that introduce additional noise). The dynamic range of an ADC is often summarized in terms of its [effective number of bits](http://en.wikipedia.org/wiki/Effective_number_of_bits) (ENOB), the number of bits of each measure it returns that are on average not noise. An ideal ADC has an ENOB equal to its resolution. ADCs are chosen to match the bandwidth and required signal to noise ratio of the signal to be quantized. If an ADC operates at a sampling rate greater than twice the bandwidth of the signal, then [perfect reconstruction](http://en.wikipedia.org/wiki/Nyquist%E2%80%93Shannon_sampling_theorem) is possible given an ideal ADC and neglecting quantization error. The presence of quantization error limits the dynamic range of even an ideal ADC, however, if the dynamic range of the ADC exceeds that of the input signal, its effects may be neglected resulting in an essentially perfect digital representation of the input signal.

An ADC may also provide an isolated measurement such as an [electronic](http://en.wikipedia.org/wiki/Electronics) device that converts an input analog [voltage](http://en.wikipedia.org/wiki/Voltage) or [current](http://en.wikipedia.org/wiki/Electric_current) to a digital number proportional to the magnitude of the voltage or current. However, some non-electronic or only partially electronic devices, such as [rotary encoders](http://en.wikipedia.org/wiki/Rotary_encoder), can also be considered ADCs. The digital output may use different coding schemes. Typically the digital output will be a [two's complement](http://en.wikipedia.org/wiki/Two%27s_complement) binary number that is proportional to the input, but there are other possibilities. An encoder, for example, might output a [Gray code](http://en.wikipedia.org/wiki/Gray_code).

1. **RESET**

Reset is used for putting the microcontroller into a 'known' condition. That practically means that microcontroller can behave rather inaccurately under certain undesirable conditions. In order to continue its proper functioning it has to be reset, meaning all registers would be placed in a starting position. Reset is not only used when microcontroller doesn't behave the way we want it to, but can also be used when trying out a device as an interrupt in program execution, or to get a microcontroller ready when loading a program.

1. **Crystal Oscillator**

A crystal oscillator is an [electronic oscillator](http://en.wikipedia.org/wiki/Electronic_oscillator) circuit that uses the mechanical [resonance](http://en.wikipedia.org/wiki/Resonance) of a vibrating [crystal](http://en.wikipedia.org/wiki/Crystal) of [piezoelectric material](http://en.wikipedia.org/wiki/Piezoelectricity#Materials) to create an electrical signal with a very precise [frequency](http://en.wikipedia.org/wiki/Frequency). This frequency is commonly used to keep track of time, to provide a stable [clock signal](http://en.wikipedia.org/wiki/Clock_signal) for microcontrollers. The most common type of piezoelectric resonator used is the [quartz](http://en.wikipedia.org/wiki/Quartz) crystal, so oscillator circuits incorporating them became known as crystal oscillators.

1. **Power Supply**

A power supply is a device that supplies [electric power](http://en.wikipedia.org/wiki/Electric_power) to an [electrical load](http://en.wikipedia.org/wiki/Electrical_load). The term is most commonly applied to [electric power converters](http://en.wikipedia.org/wiki/Electric_power_converter) that convert one form of electrical energy to another, though it may also refer to devices that convert another form of energy (mechanical, chemical, solar) to electrical energy. A [regulated power supply](http://en.wikipedia.org/wiki/Regulated_power_supply) is one that controls the output voltage or current to a specific value; the controlled value is held nearly constant despite variations in either load current or the voltage supplied by the power supply's energy source.

1. **Step down Transformers**

Step down transformers are designed to reduce electrical voltage. Their primary voltage is greater than their secondary voltage. This kind of transformer "steps down" the voltage applied to it. For instance, a step down transformer is needed to use an 110v product in a country with a 220v supply. Step down transformers convert electrical voltage from one level or phase configuration usually down to a lower level. They can include features for electrical isolation, power distribution, and control and instrumentation applications. Step down transformers typically rely on the principle of magnetic induction between coils to convert voltage and/or current levels.

1. **Rectifier**

A rectifier is an electrical device that [converts](http://en.wikipedia.org/wiki/Electric_power_conversion) [alternating current](http://en.wikipedia.org/wiki/Alternating_current) (AC), which periodically reverses direction, to [direct current](http://en.wikipedia.org/wiki/Direct_current) (DC), which flows in only one direction. The process is known as rectification. Physically, rectifiers take a number of forms, including [vacuum tube](http://en.wikipedia.org/wiki/Vacuum_tube) [diodes](http://en.wikipedia.org/wiki/Diode), [mercury-arc valves](http://en.wikipedia.org/wiki/Mercury-arc_valve), copper and selenium oxide rectifiers, [semiconductor diodes](http://en.wikipedia.org/wiki/Semiconductor_diode), [silicon-controlled rectifiers](http://en.wikipedia.org/wiki/Silicon-controlled_rectifier) and other silicon-based semiconductor switches. Historically, even synchronous electromechanical switches and motors have been used. Early radio receivers, called [crystal radios](http://en.wikipedia.org/wiki/Crystal_radio), used a "[cat's whisker](http://en.wikipedia.org/wiki/Cat%27s-whisker_detector)" of fine wire pressing on a crystal of [galena](http://en.wikipedia.org/wiki/Galena) (lead sulfide) to serve as a point-contact rectifier or "crystal detector". Rectifiers have many uses, but are often found serving as components of DC [power supplies](http://en.wikipedia.org/wiki/Power_supplies) and [high-voltage direct current](http://en.wikipedia.org/wiki/High-voltage_direct_current) power transmission systems. Rectification may serve in roles other than to generate direct current for use as a source of power. As noted, [detectors](http://en.wikipedia.org/wiki/Detector_%28radio%29) of [radio](http://en.wikipedia.org/wiki/Radio) signals serve as rectifiers. In gas heating systems [flame rectification](http://en.wikipedia.org/wiki/Flame_rectification) is used to detect presence of flame.

1. **Filters**

**Electronic filters** are [analog circuits](http://en.wikipedia.org/wiki/Analog_circuit) which perform [signal processing](http://en.wikipedia.org/wiki/Signal_processing) functions, specifically to remove unwanted frequency components from the signal, to enhance wanted ones, or both. The most common types of electronic filters are [linear filters](http://en.wikipedia.org/wiki/Linear_filters), regardless of other aspects of their design.

1. **Regulator**

A regulator is a device which has the function of maintaining a designated characteristic. It performs the activity of managing or maintaining a range of values in a machine. The measurable property of a device is managed closely by specified conditions or an advance set value; or it can be a variable according to a predetermined arrangement scheme. It can be used generally to connote any set of various controls or devices for regulating or controlling items or objects.