Biometric Authenticated Voice Operated Robot

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***Abstract*--Robotics and Automation are vast fields in industrial world which are needed in maintaining difficult job into simplest way. Today's world is getting highly automated and technologically more advanced; hence the security is one of the important factor for getting the things highly protected. We need more sophisticated and robust robots that will be easily operated. This paper describes the survey related to the biometric authentication techniques like fingerprint and voice recognition. A system is proposed in which the robot will only be enabled by an authorized person with authentic finger print and recognized voice. The proposed system is highly efficient and can be effectively used.**

Keywords--Biometric Authentication, Fingerprint Recognition, Voice Recognition, microcontroller.

I. INTRODUCTION

Biometrics is the science of identifying or verifying the identity of a person which is based on physiological or behavioral characteristics such as facial recognition, iris recognition, voice recognition [8], fingerprint, palm print recognition etc [1]. Biometrics is increasingly mapped to new civilian applications for commercial use. The tremendous growth demands for more user friendly and secured biometric systems. This has motivated researchers to explore new biometrics features and traits. A fundamental need in security is the ability to automatically verify an intruder. Out of several biometrics two systems are focused in this paper, namely finger print and voice recognition.

The development of fingerprint biometric system is most successful today due to the intrinsic properties: there is nothing to remember like passwords or to carry, like various cards. A fingerprint is an impression of the friction ridges of all or any part of the finger. A friction ridge is a raised portion on the palm or digits (fingers and toes) or plantar (sole) skin. Fingerprint is always considered as the sign of each human being [9].

The voice recognition is the technology by which sounds, words or phrases spoken by humans are converted into electrical signals. These signals are transformed into coding patterns to which meaning has been assigned. Speech is the most natural and significant means of communication and is one of the suitable choices for human robot interaction. Speech control robot system has potential in many applications where voice communication plays a crucial role. The operator only needs to speak the commands to the robot to achieve the task.

The paper consists of following sections. Section 1 discuss the brief introduction of the system. Literature survey is covered in section 2. The proposed idea with block schematic is described in section 3. Features of various modules used for implementing the system are discussed in section 4. Conclusion remarks are given in section 5.

II. LITERATURE SURVEY

A. Fingerprint Recognition

Recently lot of work has been carried out in Biometrics and its applications. Some of the fingerprint recognition methods in different applications are reviewed.

Jay Merja and Sunny [2] has used finger print recognition system to minimize railway Reservation Fraud and give more facility to traveler and make the system user friendly and simple. The fingerprint of the person who goes for reservation/ticket booking is being authenticated. Finger Print Module verifies the person's identity. By using GSM before the journey message will be send to the user with information. At time of journey ticket checker will verify fingerprint with previously stored data as a part of verification.

Dr. V. Vijayalakshmi, R.Divya and K. Jaganath [3] has proposed a multi biometric based authentication using fingerprint and palm print. For fingerprint identification an algorithm based on the Euclidian distance between the center point and their nearest neighbour bifurcation and ridge ending minutiae is used. This algorithm is divided into two steps first is enrollment stage and second is matching stage. For Palm print authentication, principal line based algorithm is given. It uses macro features of the palm print to identify a person.

Sangram Bana and Dr.Davinder Kaur [4] describes the finger print recognition system based on minutiae based matching. In this two of the minutia features i.e ridge ending and ridge bifurcation are concentrated. Minutiae based matching is classified in two stages – Minutiae extraction and Minutiae matching. Minutiae extraction includes image enhancement, image segmentation and final extraction process. Minutiae matching include minutiae alignment and matching processes.

B. Voice Recognition

Abundant literature can be found on speech processing today. Study on some of the voice recognition

methodologies used by various researchers is carried out here.

Xiaoling Lv Minglu Zhang and Hui Li [5] has designed a speech control robot system which includes two parts i.e speech recognition module and control module. In this speech recognition is done by a process Dynamic Time Warping (DTW) which is based on pattern-comparison and Mel- Frequency Cepstral Coefficients (MFCC) is used to extract the feature of the speech command. The process first acquires voice signals through microphone and performs analog- to-digital conversion. Series of pre-processing is carried out for signal analysis and then pattern matching calculation using DTW is performed.

Attoui Hamza, Mohamed Fezari, and Mouldi Bedda [6] implement a system to control the movement of five degree of freedom manipulator arm by speech recognition module. Kalman filter is used as selector in noisy environment and Hidden Markov Model (HMM) to recognize the words. The Kalman filter is a least square error filter which makes optimal use of imprecise data on a linear system with Gaussian errors. It continuously updates the best estimate of the system's current state so that the speech enhancement takes place even in presence of noisy environment. Secondly the training phase is done using Hidden Markov Model (HMM). It is stochastic model and is suitable for the classification of one or two dimensional signals and can be used when the information is incomplete or uncertain. HMM have a training phase and a test phase. For the training stage, Baum-Welch algorithm is used to estimate the parameters for the HMM. This method is based on the maximum likelihood criterion. To compute the most probable state sequence, the Viterbi algorithm is the most suitable. Once the phrase is acquired via microphone, speech processing phase is activated and during this phase the signal (samples) goes through different steps like pre-emphasis, frame blocking, windowing, feature extraction and MFCC analysis.

Mohamed Fezari and Abd-Erahman Khati [7] describes a design of an system used to control a wheelchair based on voice command. The system is designed with VR-Stamp (Voice recognition Stamp) which is voice recognition module, PIC18F252 microcontroller, ultrasonic sensors modules and joystick. In this system vocal commands are generated by simple vocal messages. The generated vocal commands are given to the voice recognition module system (VR-Stamp), which works in two phases. In training phase, the operator will pronounce the command words one by one. In this way eight words are used for training the system. In recognition phase, words are extracted and compared with reference words. If there is matching between reference word and user word an appropriate command is generated. Also a set of sensors were added to run a wheelchair safely and comfortably. So that the system is able to detect obstacles and avoid collisions.

III. PROPOSED SYSTEM

After going through literature survey it was thought that a system can be developed using these features i.e finger print and voice. An idea is proposed in which the robot will be enabled by only the authorized person through finger print recognition and voice recognition. The simple voice commands like forward, reverse, left, right and stop are used for operating the robot. The proposed system includes two sections: **A** Transmitter and **B** Receiver section.

The transmitter section is shown in Fig. 1(a) and Fig. 1(b) represents the receiver side.

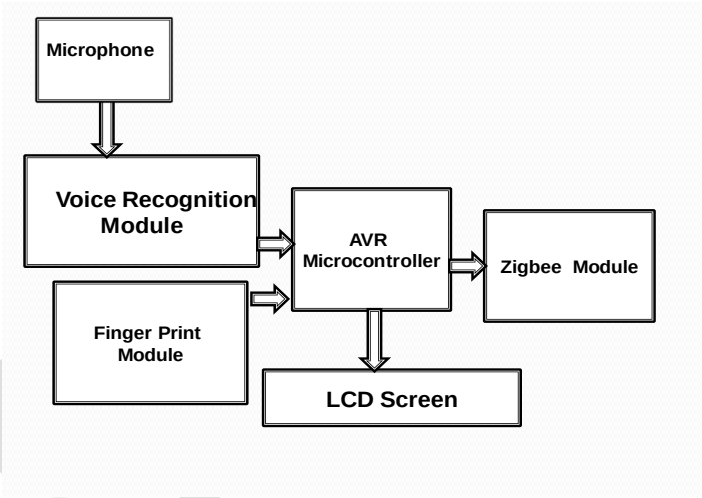

Fig. 1(a). Block Diagram of Transmitter

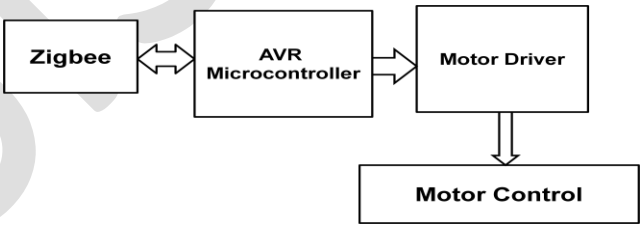

Fig. 1(b). Block Diagram of Receiver

A. Transmitter Section:

Transmitter section is used for sending the control signals to the Robot. ATmega microcontroller is used as a controlling unit. The system on transmitter side is divided in two stages.

i) Authentication Stage: This stage is used to identify the correct person whose commands will be received by the robot. It is implemented using finger print recognition module. The robot will receive the commands only when the authentic person is recognized in this stage.

ii) Voice Operation Stage: This stage is used to receive, process and transmit commands to the Robot using wireless communication. For this voice recognition kit (HM2007) is used to input voice command. Where a voice command is converted in to appropriate electrical code. Which is then given to microcontroller for decision making and activating communication link. Then the signal is transmitted to receiver side to operate a robot. In this wireless communication link is established using transmitter of Zigbee module.

Following commands are used for robot movement i) LEFT ii) RIGHT iii) FORWARD iv) BACK v) STOP.

B. Receiver Section:

On the receiver side ATmega microcontroller is used as a control circuit. Functionally this side of the system receives voice commands using receiver of Zigbee module. Which is processed by microcontroller and appropriate controls signals are generated. Which are given to motor driver circuits to operate the motors. Which in turn operate the Robot i.e. according to speech command it will move left, right, forward, back and stop.

IV. FEATURES OF MODULES IN PROPOSED SYSTEM

A. Atmel AVR Microcontroller

- 131 Powerful instructions
- 16 Kbytes of in-System self-programmable flash program memory
- 8-channel, 10-bit ADC
- Programmable serial USART
- External and internal interrupt sources
- 32 programmable I/O lines

B. Fingerprint Scanner

- Easily interface
- Automatic finger detection
- Highly encrypted for secure data connections
- Low power consumption
- Low cost

C. Speech Recognition System Kit HM2007

- Self-contained stand alone speech recognition circuit
- User programmable
- Non-volatile memory back up
- Easily interfaced to control external circuits & appliances

D. Zigbee Technology

- Low duty cycle- provides long battery life.
- Zigbee technology based devices are designed on low-power frequency therefore are reliable.
- It is used in remote controlling the devices at a specific range.
- Better way for transferring of information or data from one place to another than the other wireless devices.
- Allows wireless networking to connect several units to control through one button like in business industry.

V. CONCLUSION

As robots are used in variety of applications were security is an essential factor. We need more sophisticated and robust robots for military & other applications. The proposed system makes operation of robot highly secured and easy. It uses the most natural biometric measures i.e. finger print & voice for identification & control.

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