



Framework for Personal Security System using Bomb Detection, Metal Detection, Speech Detection, Image Classification and Robot Technology

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Abstract-- As we know, in India and other countries, most of the political leader, VIP's (very important persons), soldiers, or the citizens are died because of the lack in security provided by the corresponding departments. Even today, in metro and major cities, innocent people are dying because of lack of security. Today the technologies have improved in the area of computer science and the information technology; we have bomb detection, metal detection, speech detection, image classification and robot technologies. Using all these technologies we propose a technique to save the lives of our leaders by building ROBOTS. We also provide the use of these technologies for border security issues. Research is going on building such robot, by using which, one can save not only the lives but also lot of money.

Keywords -- Robotics, Bomb Detection, Metal Detection, Speech Detection, Image Classification.

I. INTRODUCTION

Father of our nation Mahatma Gandhi was shot and killed while having his nightly public walk on the grounds of the *Birla Bhavan* (Birla House) in New Delhi on January 30, 1948. Former Prime Minister Smt. Indira Gandhi was assassinated by her own bodyguards in 1984 and his son former Prime Minister Sri Rajeev Gandhi was assassinated On May 21, 1991. We lost many soldiers in Kargil war and, daily we are loosing our soldier lives in border places.

Terror attacks in India have increased; innocent citizens and officers are dying every day. Not only our country is facing such problems, John F. Kennedy, the 35th president of United states of America was assassinated at 12:30 p.m. Central Standard Time (18:30 UTC) on Friday, November 22, 1963, in Dealey Plaza, Dallas, Texas. Kennedy was fatally shot while traveling with his wife Jacqueline. Texas Governor, John Connally and Connally's wife Nellie was been attacked in a presidential motorcade. We can give N such examples for as an incidents, which is happened throughout the world. Being citizens of our nation, it's time to find a solution, to save our leaders life and soldier life. To do this, we need some technology or a machine that will give 24 hour security for our leaders or, in border places. We know that our technology is improved in the area of Bomb Detection, Metal Detection, Speech Detection, Image Classification and Robot Technology. We can combine all these technologies together to save the life of our leader and our soldiers. In the section 2 we will explain about different supporting technology to implement the security system. In the section 3 we describe the basic structure of the security System and the working of the security system. In section 4 we provide few advantages of the proposed security system. In this paper we propose a robot which will give solution for the mentioned problems.

II. LITERATURE SURVEY

[1] This paper helps in choosing the various speech recognition techniques along with their relative merits & demerits. A comparative study of different technique is done in stages. This paper concludes with the decision on feature direction for developing technique in human computer interface system using Marathi Language. This paper mainly concentrates on the various techniques used in the speech recognition like ASR system classification for the pattern recognition, the speech recognition techniques discusses on how the machine is able to hear, understand and act upon the speech. In the speech detection there are 4 stages, analysis, feature extraction, modeling and the testing. This paper lists all the feature extraction techniques with their properties. They have discussed about the advantages and the limitations of the various modeling technique. The performance of speech recognition systems is usually specified in terms of accuracy and speed. Accuracy may be measured in terms of performance accuracy, which is usually rated with word error rate (WER), whereas speed is measured with the real time factor. Other measures of accuracy include Single Word Error Rate (SWER) and Command Success Rate (CSR). Finally the paper concludes that MFCC (Mel-Frequency Cepstral Coefficient) is widely used for feature extraction of the speech and, GHM and HMM(Hidden Markov Models) are the best among the modeling techniques.

[2] Standoff detection of explosives using terahertz (THz) radiation is promising because those materials typically display diagnostic series of molecular THz resonances, yet many packaging or concealment materials are semi-transparent at such frequencies. Even they have discussed about the limitations of this technologies. Explosive materials feature is generated by their terahertz spectral signature and, they build library on the generated data to identify the

explosives. This technology is safe because it uses no ionizing radiation. The same technology can be used for the detection of the weapons also. But they are not sure about the ranges in which this technology works without any problem. [3] This paper introduces the haptic communication robots; study develop and propose a method for detecting human positions and postures based on haptic interaction between humanoid robots and humans. They have developed two types of humanoid robots that have tactile sensors embedded in a soft skin that covers the robot's entire body as tools for studying haptic communication. Tactile sensation could be used to detect a communicating partner's position and posture even if the vision sensor did not observe the person. Robovie-IIS is the ROBOT which is already available and, is designed to study tactile communication used in friendly relationships. It identifies the object based on the soft sensor which is kept on the whole body the robot. They employed an optical motion capturing system (VICON, Vicon Motion Systems Ltd.) to measure body movements. The motion capturing system consists of 12 pairs of infrared cameras and infrared lights and markers that reflect infrared signals. They use three markers for find the location of the human.

[4] This paper discusses about the already existing algorithms for concealed weapon detection (CWD). Existing image sensor technologies for CWD applications include thermal/Infrared (IR), Millimetre Wave (MMW) and visual. They have proposed new algorithm, which is developed for fusing visual Image and Infrared (IR) image which is based on additive wavelet decomposition. Also, proposed a new image fusion method for a concealed weapon detection application by fusing visual and IR image to provide fused image that provides a detailed description of the people in the scene and any hidden weapons detected by the IR image. Finally, the comparison with the original image with the fused image which is done based on evaluation methodology like correlation coefficient RMS error, ERGAS, Spectral Angle Mapper Classification (SAM) and BIAS, VAR and SD. [5] This paper aims at providing an automatic method for detecting concealed weapons, typically a gun in the baggage by employing image segmentation method to extract the objects of interest from the image followed by applying feature extraction methods namely, Shape context descriptor and Zernike moments. Finally, the objects are classified using fuzzy KNN as illicit or non-illicit object. In their proposed algorithm, first they will detect the shape of the image in the feature extraction base because it's very important in identifying the object type. Later stages, fuzzy KNN classifiers are used for identifying the scanned images with stored images of the illicit object. This proposed work relies on reliable features like Shape context descriptor and Zernike moments to detect concealed weapons. Proposed algorithm is tested with 15 X- ray images of the bag taken from the airport authority in which 7 images are with weapon and each images of size 310 X 1035, it is possible to achieve a good result in identifying the illicit object in the bags.

[6] In this paper author discusses about need of terahertz wave imaging techniques(TMW) over millimeter wave imaging techniques(MMW) with terahertz (> 1 THz) imaging offering enhanced imager quality and detection and discrimination of concealed objects at greater stand-off ranges than is achievable with millimeter wave imaging. Author proposes pulse synthesized, time domain approach relying on Stepped Frequency Continuous Wave (SFCW) RADAR is implemented in a phased array of antenna is proposed. Both the location of items (that support appreciable induced surface currents) are concealed on the human body and, the nature of these concealed items can be determined by making use of the well known and characteristic ringing that occurs when these items are excited with radiation that matches their resonant frequencies.

III. PROPOSED WORK

A. Proposed system for personal security

i) *Personal security introduction:* Proposed ROBOT contains a gun attached to its arm, and a inbuilt sensor inside the ROBOT will detect any metal and scan or, frequently takes image of the metals in the nearby areas. Inside the ROBOT, image classification technology is used to compare the captured image with the stored image. ROBOT includes all type of weapon images stored in it. Images captured by the ROBOT are passed through the image processing techniques before the image classifier unit of the ROBOT. Once the scanned image is matched with the stored images, it will immediately send the message to the controlling person and wait for few second for the response. If it is not received any message within the stipulated period, then without asking the order of the controlling person it will destroy target. The reason of sending the message to the controlling person is to make him aware of the danger. Within the specified time the ROBOT should receive the message from the user to immediately respond for their order. The ROBOT is build with all bomb detection, metal detection technologies and also capable of moving its arm to targets the intruders or the objects. When it detects any such dangerous things in its surrounding immediately it send message to controlling person and also cable of destroying the target.

ii) *Switching on/off of Robot:* The person to whom we deliver this ROBOT, first researcher will program it, such that the owner voice will be detected by the ROBOT using the voice detection or the speech detection technology. If the voice is matching then ROBOT will listen to the order given by that person, we call them as controlling person. Whenever the owner wants to load bullets, first they have to switch off the ROBOT by a voice saying that "shut down". Once the machine is shut down the user can load the weapons of the robot. User can switch on the ROBOT at any time by sending the voice message which is already loaded in the ROBOT for authentication purpose. ROBOT will respond to the user only through their voice orders.

iii. *Communication from user to ROBOT:* Communication is very challenging part in this research. For the communication purpose, if researcher uses Bluetooth or RADAR technology, then there is a chance for hacking the data. So it is not a right way to transfer the highly confidential data through such media. So in this research we propose to use

satellite communication for all types of the communication required by the ROBOT and the user. All data will be transferred through the satellite will be encrypted before the transmission. Researcher uses the compression technique to transfer the data so that nobody can hack the data transferred between user and the ROBOT.

B. Proposed Algorithm for Personal security ROBOT

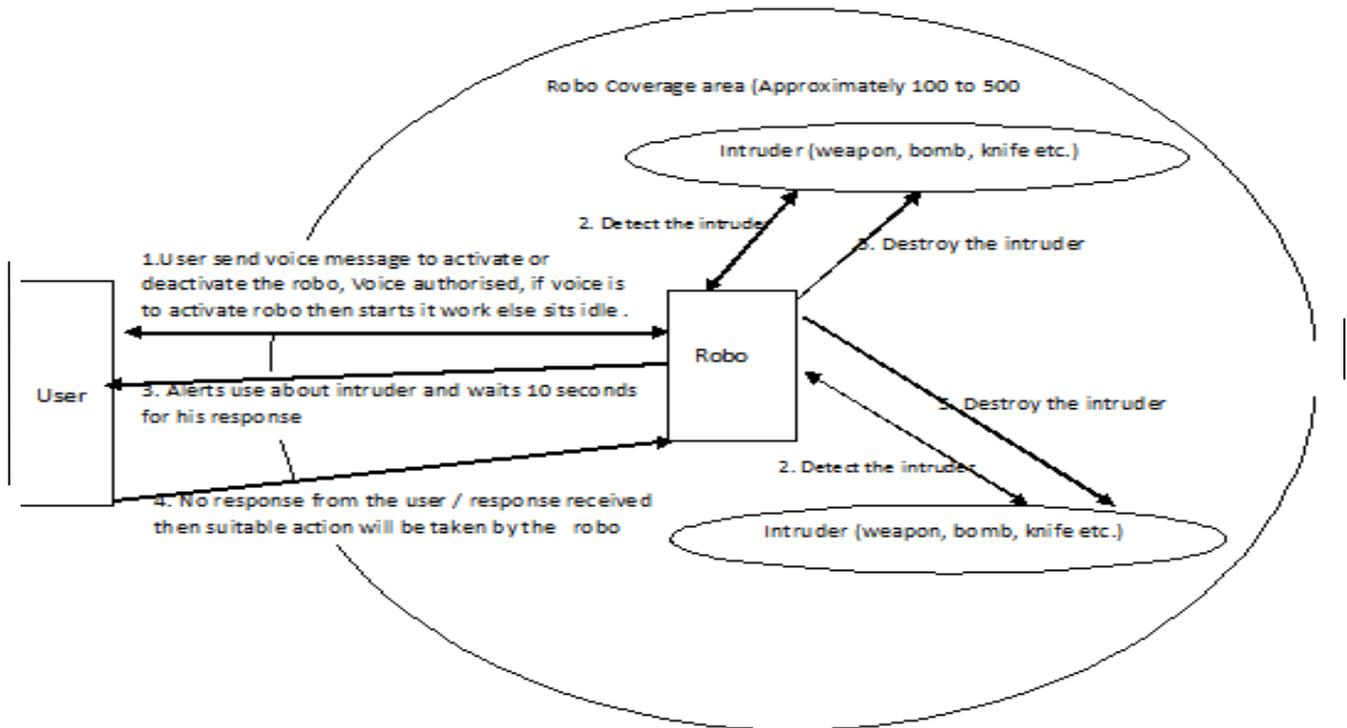


Fig.1: System architecture for Personal Security System

ROBOT security is loaded with all the necessary software required for its proper functioning. Image processing, bomb detection, metal detection, satellite communication and speech detection and the robotics is required for proposed research. ROBOT will be installed with 360 degree capture capable camera and the sensor to detect the bomb or metals. The ROBOT will capture continuous images of the surrounding area. From the taken images and using the sensors, it will detect the nearest objects or the intruder (intruder may be anything like person holding weapon's or a bomb). Once the image is captured, it will be processed and compared with the already stored images. For each images or the object, the priority level is set by the programmer. Priority level 1 for the guns or weapons, priority level 2 for metal or knife, priority level 3 is for bomb. All other objects with the priority level 4. If the ROBOT detects priority level 4, then the ROBOT will not take any action, it sends a message to the controlling person to take action. And the researcher will also train the ROBOT to detect or recognize the speech/ voice of the user, to whom it has to communicate.

Step 1: User will activate/deactivate the ROBOT by sending the voice message which is stored in it. Voice message received by the ROBOT is to switch on then goto step 2 else goto step 9.

Step 2: Once the user voice is matched with the already stored voice for the activation of the ROBOT, the ROBOT starts working by executing installed software's. Else goto step 2.

Step 3: ROBOT starts to continuously capture the images using its camera and also starts to detect for the bomb or the metal using its sensors. If the robot detects any intruder in and around its location immediately checks the intruder priority level by comparing with the stored data and immediately sends the alarm signal or message along with the information about what object is detected, to user/ controlling person headphone.

Step 4: ROBOT waits for 5 to 10 seconds for user response. Within this duration user can decide the severity of the intruder. If he feels the intruder is not harmful then he can take necessary action by sending suitable voice message to the ROBOT. ROBOT immediately skip that object or intruder comparison in the next event. If the user response is not to react then go to step 10. Else goto step 5.

Step 5: If the priority level of the intruder is detected as 1 then goto step 6. If the priority level is 2 then goto step 7. If the priority level detected is 3 goto step 8. Else goto step 10.

Step 6: The intruder is detected is gun or any weapon, then it immediately targets the person holding that gun/weapon and starts destroying the target. Person location is identified based on the captured image.

Step 7: if the intruder detected as metal or knife immediately the person holding that will targeted. The action will be taken in the similar way as explained in the previous step.

- Step 8: if Intruder detected is bomb immediately inform the location of the bomb to the user. Later the user can take suitable action to destroy the target.
- Step 9: When the Deactivate message is received by the ROBOT from the user, it will start uninstalling all its software and stops working. During this period user can load/ unload of the weapons or he can change its batteries. Goto step 11.
- Step 10: goto step 3.
- Step 11: end.

C. Proposed system for Border security

i) *Border security introduction:* The ROBOT can also be used for the border security. Many ROBOTs can be placed in the border with distance of 500 meters. Each ROBOT should be programmed to be capable of covering a distance of 500 meters radius. Each ROBOT will be loaded by bullets. It scans all 360 degree surrounding and all sides. Researcher has to design a ROBOT such that its coverage area is about 1/2 km, behind this area military people will stay. If any intruder enters that surrounding immediately ROBOT will destroy the intruder and same time it will send message to the military people who are controlling this ROBO. Intruder is not only the enemies it can be bomb, mines, planes etc... By using this ROBOT military people will come to know that somebody is trying to enter the restricted area.

ii) *Switching on/off of ROBOT:* Switching on and off of the border security system is also very similar to that of the personal ROBOT. Here the ROBOT control will be given for one of the major commando. The ROBOT should be programmed such that it will listen only to the commando voice and, send a message to only this commando. Switch on/off of the ROBOT is through sending the voice message.

iii) *Communication from commander to ROBOT:* Communication between the ROBOT and the commandos' is through the satellite communication. The research proposed uses encryption and decryption technologies for the communication to avoid any chances of hacking data by any of the intruder type.

D. Proposed Algorithm for the Border Security ROBOT

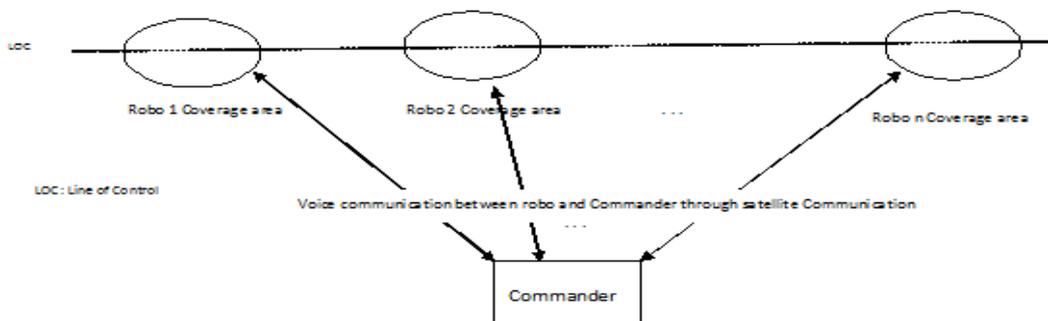


Fig.2: System architecture for Border Security ROBOT

ROBOT is pre loaded with all necessary software for its proper functioning. Communication between ROBOT and the commander takes place through the satellite communication. Priority level in this ROBOT is very similar as we explained in the personal security ROBOT. Functioning of the ROBOT is also similar way except the user here is commander and any message transfer is between the ROBOT and commander only.

- Step 1: Commander will activate/deactivate the ROBOT by sending the voice message which is already known to him. If the voice message is to switch on the ROBOT then, goto step 2 else goto step 9.
- Step 2: Once the commander voice is matched with the already stored voice for the activation of the ROBOT, then ROBO becomes active and a starts working by executing already installed software. Else goto step 2.
- Step 3: ROBOT continuously starts capturing the images using its camera and also starts to detect for the bomb or the metal using its sensors. If the ROBOT detects any intruder in and around its location immediately checks the intruder priority level by comparing with the stored data and immediately sends the alarm signal or the message along with information about what object is detected, to commander headphone.
- Step 4: ROBOT waits 5 to 10 seconds for commander response. Within this duration user can decide the severity of the intruder. If he feels the intruder is not harmful then he can take necessary action by sending suitable voice message to the ROBOT.
- ROBOT immediately skip that object or intruder comparison in the next event. If the user response is not to react then go to step 10. Else goto Step 5.
- Step 5: If the priority level of the intruder is detected as 1 then goto step 6. If the priority level is 2 then goto step 7. If the priority level detected is 3 goto step 8. Else goto step 10.
- Step 6: The intruder is detected is gun or any weapon, then it immediately targets the person holding that gun/weapon and starts destroying the target. Person location is identified based on the captured image.

Step 7: if the intruder detected as metal or knife immediately the person holding that will targeted. The action will be taken in the similar way as explained in the previous step.

Step 8: if the intruder detected is bomb immediately inform the location of the bomb to the commander. Later the commander can take suitable action to destroy the target.

Step 9: if Deactivate message is received by the ROBOT from the commander, and then it will starts uninstalling all its software and stops working. During this period user can load/ unload of the weapons and the batteries of the ROBOT. Goto step 11.

Step 10: goto step 3.

Step 11: end.

D. Limitations

- i) The ROBOT needs continuous power supply/ well backed up batteries. If the power supply stops then it will not able to give it's sent percentage performance for its user.
- ii) For the power supply user can use batteries, but they have to continuously charge its batteries whenever required.
- iii) If the intruder is in between user and the ROBOT, then use has to give space for the ROBOT to target the intruder, otherwise there is a chance that ROBOT will target the user.
- iv) Those who want to visit the user they have to know, not to carry any metal, knife or any kind of weapons. This instruction should be provided to all the visitor of the user.
- v) Some time user may feel it is difficult to control the ROBOT and the visitor; the user can give the ROBOT control to his or her believable person.
- vi) ROBOT Coverage area is limited to 100 to 500 meters.

IV. CONCLUSION

This research will prove useful for the citizens or the old people those who stay alone in their home. People are investing huge amount of money for their security purpose. Most of the developed and under development countries they are investing huge amount of money to protect their leaders. By using the proposed ROBOT, one can save approximately 5 to 10 percentage of their total revenues. This ROBOT are human made, so anybody can believe on its performance. If this ROBOT is used in the border areas by the military, then at any situation this ROBOT will give its full performance. In few countries and in certain region the army cannot keep their militaries for entire 365 days because of the bad weather, in such places this robot can be used. If the user feels that the object detected is not harmful, at any time he can stop the activities of the ROBOT.

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