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Concealed Weapon Detection System Development

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Introduction
This research aims to design and develop a Concealed Weapon Detection (CWD) system which will be able to accurately distinguish between lethal and non-lethal metallic objects. This system can be deployed in large areas where preliminary search is required, i.e., schools, airports, corridors, entrance to apartments, stadiums, outdoor events etc.

Why this system?
- Threat is determined & tracked in real time
- No invasion of privacy unlike other weapon detection system
- Unlike imaging based detection, no human interpretation of threat is necessary
- As list of threat objects grows ever longer so also the increased risk of error & inconsistency in judgment for operator
- Low false alarm rate as compared to other weapon detectors
- Array architecture and multiple transmitter & receiver gives no dead zone in the system

System Operation
- All metallic objects in a time varying magnetic field produce eddy currents which decays with time (known as time constant).
- This unique property of metal is dependent on size, shape & physical composition of metal. Hence a weapon database could be created using time constant as object signature. Details of object signature of a gun is shown in Fig 1

Multi Zonal Array Architecture
- Arrangement of coils in multiple zones in an array improves the weapon detection & threat is monitored in real time
- Object signature of metallic object is analysed and compared with weapon database. This reduces false alarms created by commonly used non-lethal objects such as key rings, watch, belt buckle, coins etc.
- Fig 2 shows multi zonal array architecture of CWD system.

Signal Block Diagram
- Trigger circuit is used to control the pulse frequency of the transmitter
- Induced eddy current decay time is measured from receiver coils. It is then processed & compared with weapon database to create an alarm if object signature is matched with signature in the weapon database. A CCTV tracking system is activated to monitor any individual carrying a suspicious object in real time
- Fig 3 shows the signal block diagram of CWD system.

Research Tasks
- Signature database for threats
- Fast coils for better performance
- High speed signal processing for faster detection
- Integration with neural analyzer for better threat classification