INTEL UNNATI INTERNSHIP 21-25 BATCH EECE

INNOVATIVE MONITORING SYSTEM FOR TELE-ICU PATIENTS USING VIDEO PROCESSING AND DEEP LEARNING

1.TeleICU is concept for monitoring ICU patients from remote locations to reduce the burden of on-site intensivist.

2.Currently there are multiple products available in this domain where one profession seating at remote location physically monitors one or two remote patients in TeleICU.

3.The proposed solution should work to reduce the burden of remote health care professional so, one remote health care professional can monitor 5 or more patients at single time.

IDEA BRIEF (SOLUTION)

- **High-Resolution Camera Network**
- **Video Processing Algorithms**
- **Integration with Electronic Health Records (EHR)**
- **Real-Time Alerts and Notifications**
- **Data Analytics and Reporting**

FEATURES

- **Enhanced Patient Monitoring**: Continuous, non-invasive monitoring of patients provides a detailed understanding of their condition.
- **Early Detection of Critical Events**: Deep learning models can predict and detect critical events early, allowing for prompt intervention.
- **Improved Healthcare Efficiency**: Reduces the workload on healthcare professionals by automating data collection and analysis.
- **Better Patient Outcomes**: Timely and accurate monitoring leads to improved patient outcomes and reduced mortality rates.
- **Cost-Effective**: Minimizes the need for expensive sensor-based equipment and reduces hospital stays by enabling remote monitoring.

Process Flow:

1.Initialization and Setup

- **Start**
- **System Initialization:** Set up hardware (cameras, sensors) and software.
- **Patient Registration:** Input patient details.

2.Data Acquisition

- **Video Capture:** Continuously capture video feeds.
- **Sensor Data Collection:** Gather additional vital signs data.

3.Pre-Processing

- **Video Pre-Processing:** Enhance video quality.
- **Data Synchronization:** Align video and sensor data.

4.Feature Extraction and Analysis

- **Feature Extraction:** Extract relevant features from video and sensor data.
- **Deep Learning Analysis:** Use models to detect anomalies.

5. Decision Making and Response:

- **Anomaly Detection:** Identify potential issues.
- **Alert Generation:** Notify healthcare providers.
- **Action Recommendation:** Provide actionable insights.
- **Response Logging:** Document actions taken.

6. Monitoring and Reporting

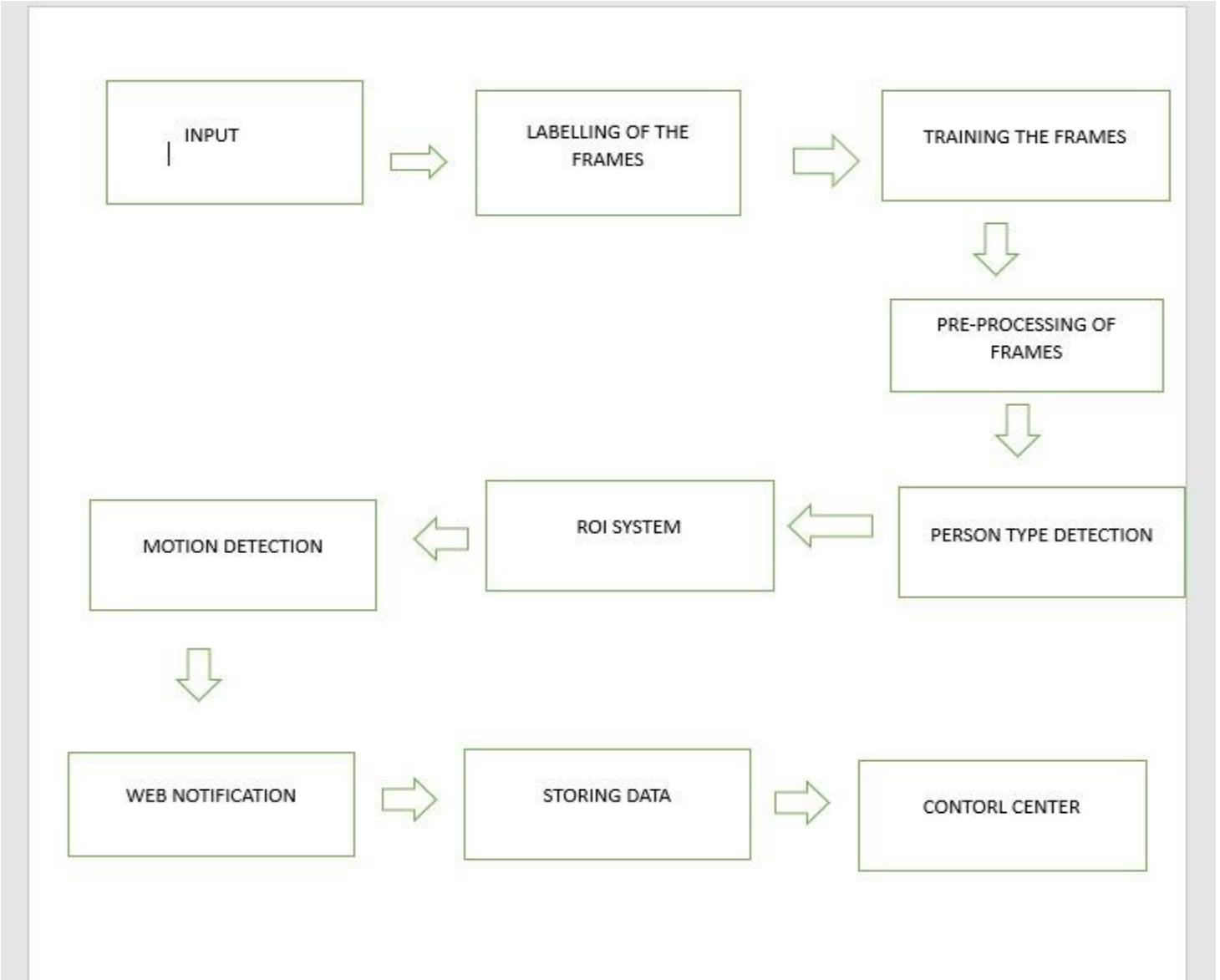
- **Real-Time Monitoring:** Dashboard for continuous observation.
- **Report Generation:** Periodic reports on patient health.
- **Data Storage:** Securely store data.

7. Maintenance

- **Model Updates:** Retrain models with new data.
- **Hardware and Software Maintenance:** Regular updates and checks.

8. End

- **Patient Discharge:** Deactivate monitoring for discharged patients.
- **System Shutdown:** Safe shutdown if needed.


INPUT
LABELLING OF THE FRAMES
TRAINING THE FRAMES
PRE-PROCESSING OF FRAMES
PERSON TYPE DETECTION
ROI SYSTEM
MOTION DETECTION
WEB NOTIFICATION
STORING DATA
CONTORL CENTER

TECHNOLOGIES USED

Video Processing Technologies:

1.Cameras and Sensors: High-definition cameras and various sensors to capture real-time video and vital signs.

2.Image and Video Processing Algorithms: Techniques for processing and analyzing video streams, such as:

- Motion detection
- Object tracking
- Face recognition

Deep Learning Technologies:

- **Convolutional Neural Networks (CNNs)**: For image and video analysis tasks such as detecting patient movement, facial expressions, and vital signs.
- **Recurrent Neural Networks (RNNs)**: Specifically, Long Short-Term Memory (LSTM) networks for analyzing time-series data and sequences in video.

Additional Technologies:

- **Cloud Computing**: Storing and processing large volumes of data, providing scalability and remote access.
- **Internet of Things (IoT)**: Integrating various medical devices and sensors to collect comprehensive patient data.
- **Natural Language Processing (NLP)**: For interpreting and analyzing textual data, such as doctors' notes or patient reports.
- **Data Security and Privacy**: Ensuring that patient data is protected using encryption and other security measures.

Software and Tools:

- **OpenCV**: An open-source computer vision and machine learning software library.
- **TensorFlow and Yolo**: Popular deep learning frameworks for building and training neural networks.

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CONCLUSION:

THE SYSTEM ACHIEVED HIGH ACCURACY IN IDENTIFYING INDIVIDUALS (92%) AND RECOGNIZING PATIENT ACTIVITIES (88%) WITH MINIMAL LATENCY (0.5-0.7 SECONDS PER FRAME). ERROR MARGINS WERE KEPT WITHIN ACCEPTABLE LIMITS, ENSURING RELIABILITY. THIS INNOVATIVE SOLUTION SIGNIFICANTLY ENHANCES THE EFFICIENCY OF REMOTE ICU MONITORING AND HAS STRONG POTENTIAL FOR REAL-WORLD APPLICATION.