Project change – NewbornTime

REK application number **222455**

Date: 20.11.23

With this notification of change we are applying for the following:

1. NewbornTime`s participation in the EU project LINK
2. Minor updates on the use of thermal videos for detection of activities around the birth

NewbornTime`s participation in the EU project LINK

In the NewbornTime project one of the objectives and deliverables is to deploy a system pilot called *NewbornTimeline* at Stavanger University hospital. The *NewbornTimeline* has the following objectives: 1) to collect video data from labour rooms and newborn resuscitations, 2) to transport the data to an edge computer where the data will be processed, 3) utilize AI models to generate event and activity timelines that can be used by the hospital, and 4) communicate with and transfer data to and from the cloud, to continuously utilize new data and improve and monitor the productionized AI models.

In the NewbornTime project protocol we do not describe the *NewbornTimeline* implementation in detail, but state that it will be implemented on an edge computer utilizing Windows services and that it will utilize cloud solutions. Since *NewbornTimeline* need to communicate with, and carry out AI model retraining in the cloud, we need to carefully consider how to securely develop and integrate the system into the hospital setting. To ensure this we have been actively searching for expertise on this field to assist us in this process. Through colleagues at our department at the University of Stavanger we have been invited to participate in a project proposal called Limiting Intrusion Navigating the Kingdom of secure AI (LINK). The project is led by IKERLAN, Spain, and will apply for funding through the for the European Horizon call *HORIZON-CL3-2023-CS-01-03: Security of robust AI systems.*

The objective of the LINK project is to develop and implement frameworks for AI models that focus on safe and secure solutions that will be robust against potential attacks. If funded, LINK will have three use-cases where they demonstrate their solutions, and *NewbornTimeline* is proposed to be one of them. The LINK project consists of 14 consortium members and if accepted, UiS will be given funding for one Phd position as well as additional research-time for supervision and integration. The PhD student will be a part of the LINK project working on tasks for secure AI systems, and will participate in development and and integration of the *NewbornTimeline* system. We will continue to treat data from NewbornTime securely and with strict access control and will not share NewbornTime video data with the LINK consortium. The LINK PhD student that will be hired at UiS will get access to the necessary parts of the system and data at UiS and/ or at SUS after signing confidentiality agreement. The supervisors will be Ozgur Ferhat (bitYoga, UiS), Kjersti Engan (UiS) and Øyvind Meinich-Bache (UiS/Laerdal medical), all already working on the NewbornTime project. We consider NewbornTime`s participation in the LINK project as an excellent opportunity to ensure that *NewbornTimeline pilot* is implemented at SUS in a safe and secure manner.

Use of thermal videos for detection of activities around the birth

Some relevant parts copied from the original protocol:

The NewbornTime project will develop a complete automated AI based system, NewbornTimeline, generating a timeline including ToB and resuscitation activities like ventilation, stimulation, suction, as well as the number of health care providers involved. The system input will be based on thermal video from the delivery room and RGB video from the resuscitation table.

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Project main objective (OM) and aim: *The NewbornTime project aims to utilize video recordings from births and newborn resuscitations to develop an AI-based intelligent system, NewbornTimeline, for automatic timeline generation of birth and resuscitation activities, as illustrated in Figure 1.*

OS1: Develop system to automatically detect time of birth based on thermal camera.

OS2: Develop semi-supervised and adaptive DNN models for activity recognition from untrimmed video, and partly unlabeled and weakly labeled videos.

OS3: Implement a digital patient consent handling and video data collection system to facilitate secure and accountable data collection.

OS4: Implement a NewbornTimeline pilot on-site at partner hospital.

OS5: Evaluate compliance to guidelines and identify successful resuscitation activity patterns.

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We will mount two thermal cameras in 5 delivery rooms at SUS to detect the birth and use thermal cameras and RGB cameras to recognize the resuscitation activities at the resuscitation station.

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WP3 System Development *(connected to OS1 and OS2).*

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The ToB will be detected using image pre-processing techniques, adaptive thresholding, and object detection CNNs *to reveal the presence and the position of the newborn. Drying/stimulation will be detected from motion analysis, such as methods for optical flow estimation, and/or deep learning activity recognition networks, e.g. 3D CNNs.*

WP5 Medical Analysis *(connected to OS5 and RQ6).*

For WP5 newborn timelines will be analyzed for compliance to current international resuscitation guidelines, most importantly the ***time from birth to initiation of PPV*** *in non- breathing infants critical for survival and morbidity. The* ***timing and duration of all relevant resuscitation activities will be collected and analyzed*** *for both debriefing purposes and to develop data-driven simulation training after events. This includes the number of ventilations per minute, drying and stimulation, assessment of heart rate, and timing, duration and number of suctioning and intubation attempts, chest compressions, and timing of first cry/spontaneous breathing or death.*

To be able to identify successful resuscitation activity patterns, the activity patterns have to be seen in relation to clinical outcomes and parameters. ***The following parameters will be Clinical variables:*** *From the medical journals Natus from the mother and DIPS from the newborn we will collect relevant information on the delivery, such as risk factors for complications at the time of birth, modes of delivery, gestational age, birthweight, gender, umbilical cord blood gases, and newborn outcomes and resuscitative interventions, admission to Neonatal Intensive Care Unit, first blood gas, and therapeutic hypothermia treatment etc.*

Updates:

1. To include more births, we have now spread the cameras, so there is now one camera in 8 delivery rooms + 2 cameras in the operating theatre. We have updated the text in the protocol attached.

2. We detect and follow activities relevant to the birth and the status of the neonate from the labor room, using thermal camera, and if the infant is moved to the resuscitation room, using the visual light and thermal cameras.
   We hereby want to make the list of activities we follow at the labor room more specific. We will identify the time and duration of the following activities as well as the response to the activities in terms of heart rate data from the NeoBeat:

   - Time of Birth. This can be more difficult in some positions than others, therefore we also want to look at the position of the mother at time of birth.
   - Cord Clamping
   - Drying/stimulation
   - Skin-to-skin with mother
   - palpate/auscultate the heartbeat.
   - Suction of airways
   - Other possibly relevant activities in the labor room

Updating the protocol, we also added a list of the activities we follow at the resuscitation station. All of the points on the list have been included earlier, and this is just for clarification in the protocol.

The activities we follow at the resuscitation room includes:

- Drying
- stimulation
- palpate/auscultate the heartbeat.
- Suction of airways, intubation
- CPAP – Continuous positive airway pressure
- PPV – Positive pressure ventilation
- Chest compression
- Injections
- timing of first cry/spontaneous breathing or death
- Other possibly relevant activities in the resuscitation room