

Technologies developed at Quality of Life Technology Laboratory

- **AI for Breast cancer detection**
 - Accuracy 95.1%; FDA clearance obtained; patents pending
- **AI for Heart Arrhythmia Detection**
 - 15+ Arrhythmia, Highly accurate, Under preparation for FDA clearance, 1 patent granted, 1 patent application pending; won 2nd place in International Competition
- **AI for Sleep Apnea and Sleep Quality Estimation**
 - Based on ECG, Oximetry ; 1 patent granted
- **AI for Oral Cancer Detection using a smart Phone**
 - International collaboration to collect data; will be tested and deployed internationally
- **Early Prediction of Respiratory Episodes using AI**
 - Uses Indoor environment + weather and Peak-flow meter reading
- **Next Generation Telemedicine Platform**
 - Capable of creating an immersive doctor office visit right from the home
- **AI based Self-management of Heart Failure**
 - Successfully tested on 13 patients in Texas Health Cleburn Hospital, Cleburn, TX

Research at Quality of Life Technology Laboratory

- **Quantum Machine Learning**
 - Using IBM facility, building algorithms that use less training data than classical machine learning
- **Racially Unbiased AI**
 - Collecting data and collaborating internationally to achieve unbiased AI, one patent application pending on the architecture
- **Explainable AI for Medical Images**
 - In collaboration with Dr. Gopal Gupta
- **Building a 5G Innovation Lab for Virtual Healthcare**
 - In collaboration with JSoM; AT&T and Ericsson are partners
- **Edge-computing and TinyML**
 - In collaboration with Dr. Tooraj Nikoubin
- **AI/ML for Medical imaging**
 - 2D/3D mammogram, ultrasound, x-ray, MRI
 - Oral Cancer Detection
 - In collaboration with Dr. Kathy Brown and Dr. C. S. Mani (Apollo Hospital, Chennai, India)

The Breast Cancer Challenge – Catching the Smallest of Tumors in Patients of All races

Today's AI systems have difficulty detecting small or obscured tumors within dense breast tissue and are racially/ethnically biased.

Our unbiased AI system can detect tumors in these problematic cases.

Metric	Result
AUC-ROC	95.6% [95% CI 0.9141-0.9817]
Sensitivity	87.21%
Specificity	90.25%

Red Reference annotation by radiologist (ground-truth)

Orange ROI annotated by algorithm as suspicious

<https://automammogram.utdallas.edu>

R cc



L cc

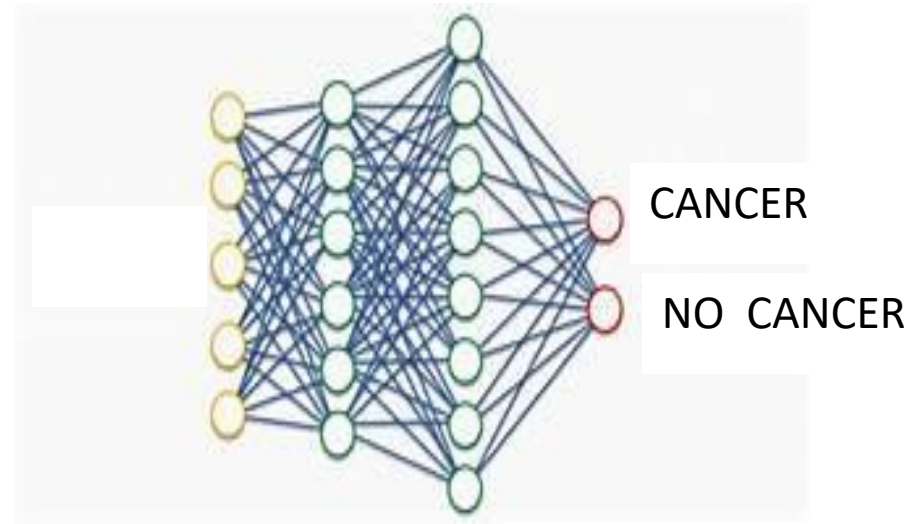
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AUTOMATED ORAL CANCER DETECTION



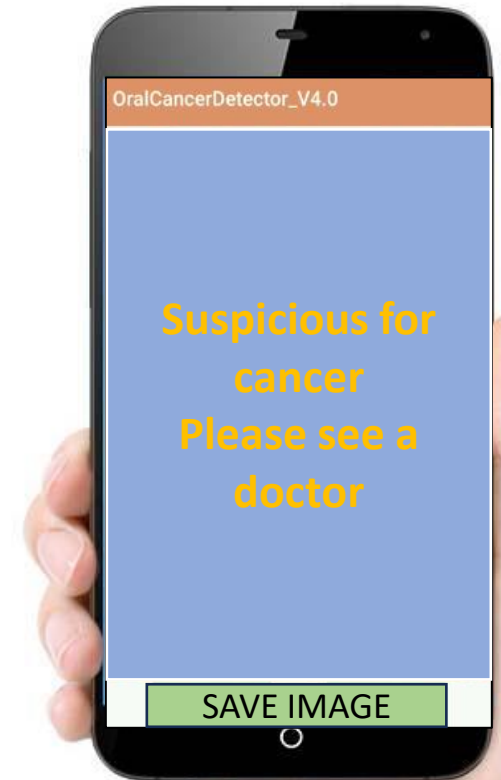
TensorFlow Lite



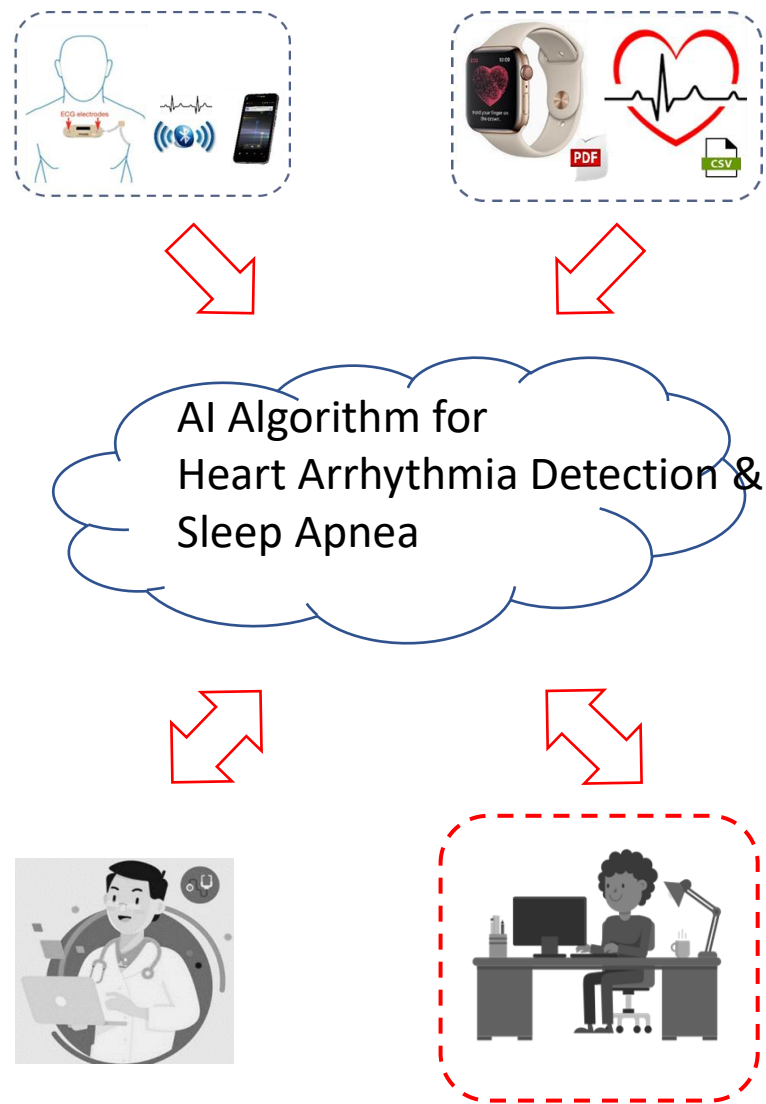
TinyML

IMAGE PREPROCESSING

- Read image
- Resize image
- Remove noise
- Segmentation
- Morphology



Machine Learning Algorithm for Heart Arrhythmia Detection (15)



Results as published in IEEE EMBC 2020 conference, July 20-24, 2020

Metric	QRS Detection ^a	AF Detection ^b	PVC Detection ^a	VT/VF Detection ^c
Sensitivity	99.61%	96.88%	92.67%	97.90%
Precision	99.88%	98.87%	95.58%	95.77%
F-Score	99.74%	97.86%	94.1-%	96.82%

^a Results fr MIT-BIH Arrhythmia Database records

^b Results for MIT-BIH Atrial Fibrillation Database records

^c Results for Malignant Ventricular Ectopy Database, AHA Database records

Patents:

US 2022/0015711 A1 **Pending**

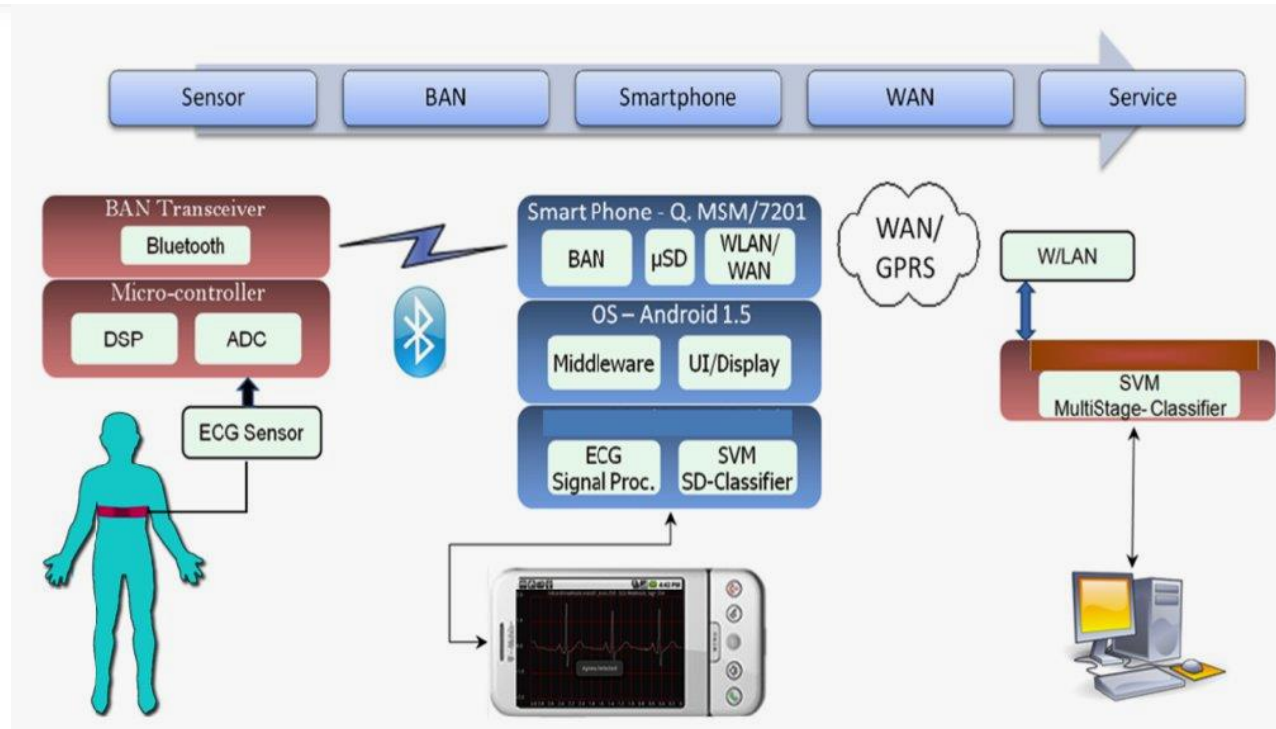
US 2015/9,161,705 B2 **Issued**

Awards:

**Runner-up at the 2020 Annual
Physionet/Computing
in Cardiology Challenge**

<https://autoecg.utdallas.edu>

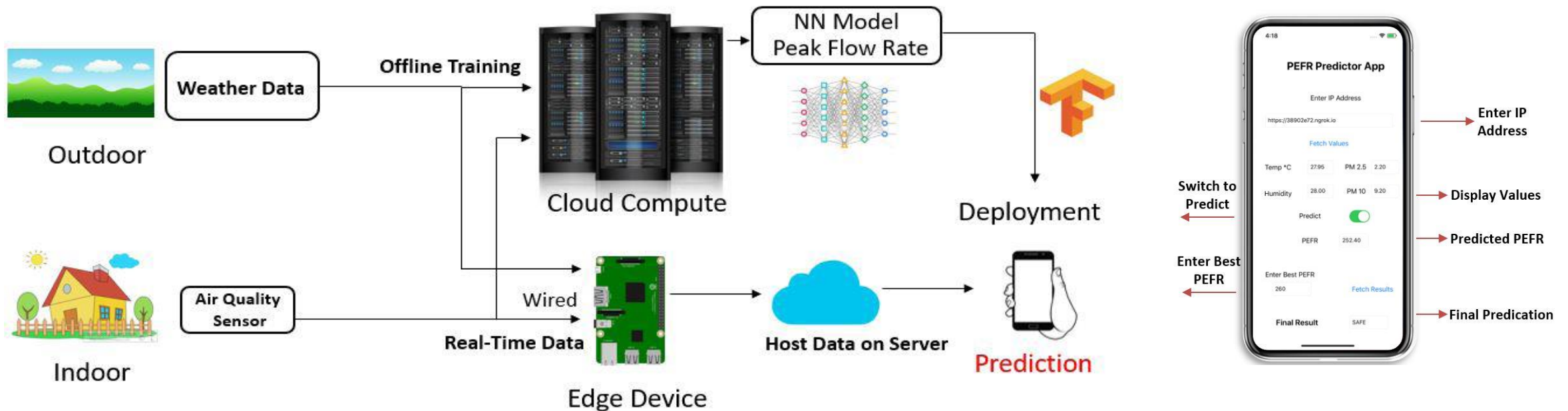
Real-time Assessment of Obstructive Sleep Apnea and Sleep Quality Using ECG and Machine Learning



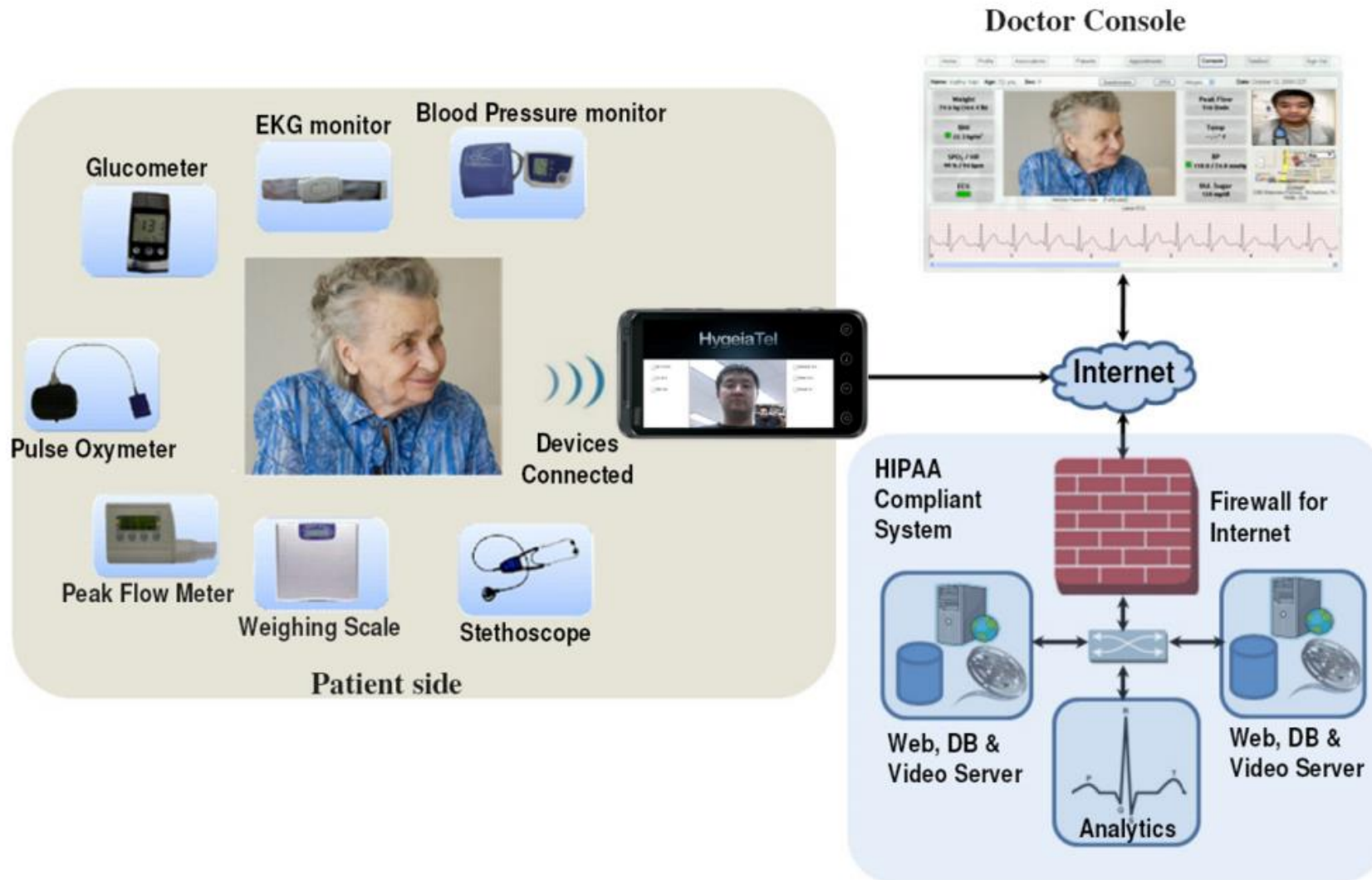
- Patent:
US 2013/0046151 A1 Issued.

- M. Bsoul, H. Minn and L. Tamil, "Apnea MedAssist: Real time sleep apnea monitor using sing-lead ECG," IEEE Trans. Info. Technol. in Bio. Med. vol.15, no. 3, pp. 416-427, May. 2011.
- M. Bsoul, H. Minn, M. Nourani, G. Gopal and L. Tamil, "Real-time Sleep Quality Assessment using Single-lead ECG and Multi-stage Classifier," 32nd Annual Int. Conf. of the IEEE Engrg. in Med. and Bio. Soc., Buenos Aires, Argentina, Aug. 31-Sept. 4, 2010.

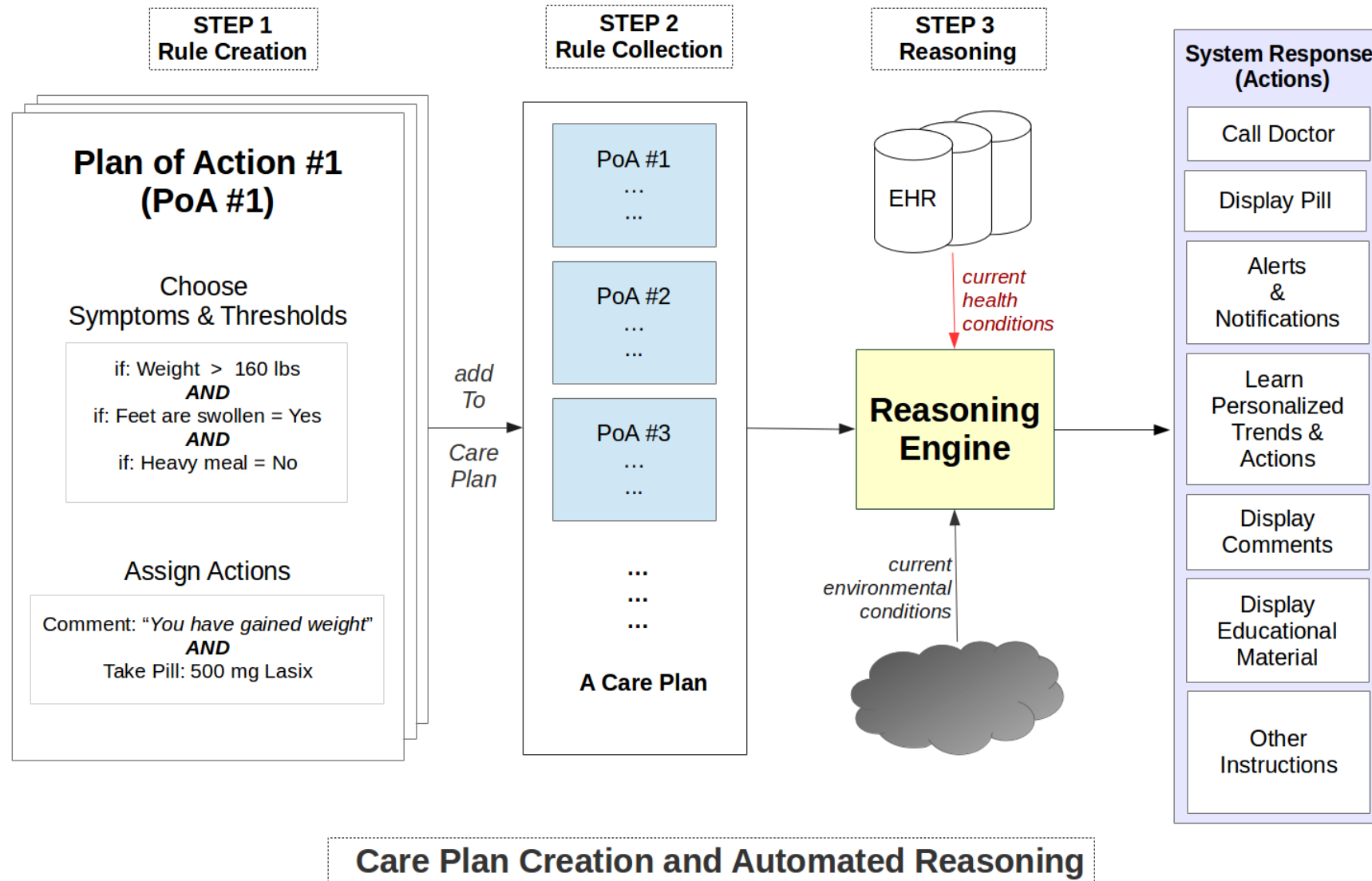
Machine Learning-Based Asthma Risk Prediction Using Peak Expiratory Flow meter, Particulate PM2.5 and PM10 sensors and Smartphone



Immersive virtual Clinic with Integrated AI



Disease Management using Automated Reasoning



In a clinical trial of 13 patients to manage Heart failure patients at home, succeeded in keeping 12 at home for 30 days.