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Non-Invasive Blood Glucose Monitoring System

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The Problem

- 2013: 382 million worldwide have diabetes → expected to increase by 55% to 592 million by 2035
- 26 million Americans have diabetes → 3 million are type 1 diabetics
- Hypoglycemia is a drop in the blood glucose
- As time progresses, the diabetic cannot feel this drop and is diagnosed with hypoglycemic unawareness
- Hypoglycemic unawareness is a threat to diabetics, side effects of hypoglycemia include: organ damage, convulsions, coma, and especially dangerous while sleeping
- Symptoms & Biological markers of hypoglycemia include: sweating, increased heart rate, cognitive dysfunction, dizziness, and other emotional marker (i.e. anger, tired, irritability, etc.)
- Current solutions fall short:
  - Blood glucose meters and continuous glucose monitors are invasive, cause patient discomfort, and require the patient to self-awaken
  - Current non-invasive glucose detection systems are inaccurate
- How can we solve this problem?

The Design

- To design a non-invasive solution to nocturnal hypoglycemia, capable of detecting hypoglycemia in type 1 diabetics during sleep that will alert them to wake up.
- Measurements taken to detect this include:
  - Heart Rate
  - Skin Conductance
- Couple these two measurements together to have a higher accuracy and sensitivity of detecting hypoglycemia during sleep
- Design basics include:
  - Diabetic wears a compressive t-shirt that houses a microcontroller
  - Attached to the microcontroller are:
    - ECG leads (for heart rate detection)
    - Skin conductance sensors (for detecting sweat)
- Implications:
  - Parental and patient peace of mind → better sleeping patterns
  - Decreased risk for hypoglycemic attack → prevents future problems from hypoglycemia
  - Other Considerations include:
    - Wearability during sleep → Human Factors
    - Effectiveness
    - Potential Market

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