Current Research on Monitoring Systems

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Research Breadth

- Range of applications: Domiciliary Health Care (patterns of behaviour, falls, precursors to falls, seizures, environment)
- Neonate monitoring.
- Non invasive point of care detection of infection in urine; skin condition (e.g., bilirubin/jaundice); wound healing; tumour identification; particulate detection (asthma); sugar in urine.
- Point of care detection STDs.
- Sensor City initiative.
UNDERPINNING TECHNOLOGY - CHROMATICITY

• Defines *information* in terms of a *limited number of cross correlated signals*.

• Uses *non orthogonal* responses in different domains (e.g. Spatial, temporal, sensory domains etc).

• A methodology that quantifies the effect of a stimulus in terms of variations in such signal parameters - i.e. it is an ideal approach to monitoring changes and to monitoring of complex conditions.

• It is a *highly flexible* approach and uses readily available detectors and sources but in an *unconventional* manner.

[Chromatic Monitoring of Complex Conditions]
Methodology Continued

- A monitoring system based on conventional sensors but deploy unconventionally can be used as a domiciliary health care monitoring system.
- Chromatic processing in a number of domains leads to the extraction of latent information from complex data which can be readily interpreted.
- A number of sensing units can be multiplexed with one central processing unit for increased cost effective monitoring.
- The system can be used for monitoring other vulnerable sections of the community (e.g. Alzheimer's, self harm etc)
- May also have applications for security (e.g. Securing the safety of lone workers, identification of abnormal patterns of behaviour etc).

Domiciliary and Health Monitoring

• **Ageing** population profile.
• Increasing **cost** of healthcare especially for the elderly.
• The demand on the health care infrastructure may become **unsustainable**?
• At present monitoring systems for the elderly are **reactive**.
• For example when someone falls it is **too late**!
• A system needs to be able to detect serious events and to detect **precursors** to these events leading to **timely intervention**.
• Such a monitoring system has to be **cost effective** to make it **economically viable**.
Domiciliary and healthcare monitoring

PORTS/PIRCS installation
Spatial Processing – patterns of movement

PORS – Pseudo Optical Radar System

PIRCS – Passive Infrared Chromatic System
Detection of behaviour over 8 months period

*Immobility* $L_L$ ($L_I$) versus *Activity* ($A$)
Detection of behaviour over 8 months period
Activity versus Immobility $S_i$ ($S_i$)

Normalized $A$ (minutes)

- High $A$
- Normal $A$
- Low $A$
- Low $S_i$
- Normal $S_i$
- High $S_i$
- Agitated
Neonatal monitoring – Liverpool Women’s Hospital

Eg bilirubin, monitoring the effect of treatment without taking a blood samples.
The technology makes it easier for screening newborn babies for jaundice level via MMS without the need for sophisticated back up facilities. Multimedia Messaging Service, or MMS, is a standard way to send messages that include multimedia content to and from mobile phones. Technology will fill the current need in medical test by improving upon an existing technology which is clearly defined and acknowledged by medical professionals. CMHT holds the exclusive license to market in India.
Do elderly patients need attend surgery/hospital? 
Point of Care – Rapid diagnosis of urinary infection based on DNA or RNA amplification, extraction and biomarker.
CHROMATIC MONITORING OF LIQUIDS AND FLUIDS USING A PORTABLE PC AND WEBCAM SYSTEM FOR DETECTING URINARY TRACT INFECTIONS
CHROMATIC MONITORING OF URINARY TRACT INFECTION

UNFILTERED URINE & ECOLI - SPIKED
Screen, WC, BC, UV

R(UV)

Non ECOLI (UV)

Pure ECOLI (UV)

Non ECOLI  (UV)

B(UV)
Mobile phone based monitoring system for the detection of PM2 particles
Particle monitoring – Respiratory illness

TELECHROM (Particulate Monitoring at Malawi)
Lightness and Instantaneous Particle Concentration VS Time
for Test No: 2

Graph showing the lightness and instantaneous particle concentration versus time, with data points at intervals from 9:02 AM to 10:02 AM.
H-S Chromatic Signatures of Various Particles
Sensor City –
A Global Hub for Sensor Technologies

• Sensors and IoT are driving the next wave of technological innovation, transforming lives and growing the economy.

• By connecting digital devices to the physical world around them, the impact of these emerging technologies on our data-driven society is limitless.

• We have created a global hub for sensor technologies.
LCR 4.0
Together for Manufacturing.
LCR 4.0 aims to:

- Assist Small to Medium Size Enterprises (SMEs) to adopt Industry 4.0 technologies
- Deliver fully subsidised support to 300 SMEs in the Liverpool City Region (LCR).
- Enable collaborations between 200 businesses and partners
- Support 70 new product development cases across a number of firms
- Create 60 new jobs in supported businesses
- Create a virtual workspace for LCR manufacturing community
- Demonstrate the potential of data-driven innovation in manufacturing