Project Proposal

ECEN 5833: Low Power Embedded Design Techniques

**CUBIT**

**Smart Measuring Instrument**

**Team Name:** Cubit

**Team Members:** Rajat Chaple

Saloni Shah

**Background:**

A measuring tape is used in a myriad of commercial businesses like construction, tailoring, warehouses as well as in day-to-day life. The first standard measuring tape was invented in 1850s and till now we have been using the same product. Although, since 18th century the world has advanced in every possible way, we still use the same measurement technique. The conventional measuring tape has ample of drawbacks like taking and maintaining measurements is very tedious, also all the measurements taken are majorly single use. It is high time that we modernize our method of taking measurements and digitize the data which can be easily stored and accessed from anywhere.

**Project Summary:**

For the course project, our team is designing a smart measuring instrument which will have the capability to take precise linear and angular measurements and transmit the data over to a mobile application using Bluetooth. Primarily, this device will have an encoder-wheel assembly which can be used to take measurements over a straight or curved surface very accurately. A high precision rotary encoder will be helpful in giving high resolution results. Moreover, we will also install an inertial measurement unit (IMU) sensor to take different angular and device orientation data. Both measurements can then be transmitted to a mobile app connected to the product using Bluetooth. This data will also be displayed on an LCD. This device will run on a small battery, and it will also contain an energy harvesting system using solar panel to recharge the battery. All these components will be interfaced with a single Blue Gecko board. The device will operate in low power mode by implementing load power management and utilizing minimum current for required peripherals.

108cm  
0°

Measuring Tape

Wheel fixed on rotary encoder

LCD

Fig 1: Product Concept

**Product Application:**

* This product can be used to fulfill majority of measurement requirements like taking size data of a straight or uneven surface and taking angle measurements.
* This product can be used in small industries, construction sites, fashion companies and regular households.
* This product will eliminate the need to manually store measured data.
* This product will be low cost, low power consuming with energy harvesting mechanism.
* This product will use long lasting rechargeable batteries unlike single usage dry cells.

**Block Diagram:**

Micro-controller  
Blue Gecko EFR32

IMU sensor

Rotary Encoder

Power Management

Battery

Solar panel-based charging

LCD Display

**Product Components:**

|  |  |  |  |
| --- | --- | --- | --- |
| Component |  | Part No. | Load Power Management |
| Microcontroller | Silicon Labs Blue Gecko |  |  |
| Radio | EFR32BG13 |  | 🗸 |
| Battery | Lithium Ion/Lithium Polymer | TBD |  |
| Sensor | IMU sensor | BNO005 | 🗸 |
|  | Rotary Encoder | TBD | 🗸 |
| HMI | LCD Display/Push buttons | TBD | 🗸 |
| Energy Harvesting System | Solar cells | TBD |  |

**Proposed Product Demo:**

0cm  
0°

Measuring Tape

36cm  
0°

Measuring Tape

108cm  
0°

Measuring Tape

As shown in the above image, this measuring tape can be used to measure any surface. The wheel encoder assembly installed on the product can be slid over a flat or uneven surface to get size value accurately. This measuring tape will have a high resolution in centimeter because of the use of a precision Rotary encoder with large number of pulse detection in a single rotation.

108cm  
0°

Measuring Tape

108cm  
30°

Measuring Tape

The above image shows how an angle measurement can be carried out using the product. This angle can be measured in any orientation of the device. The angle measurement will also be highly accurate due to the IMU sensor.

**Product Features:**

* Free android app to store and manage measurement data
* Bluetooth connectivity of mobile phone with the device
* Rotary encoder-wheel assembly for linear measurement
* IMU sensor for accurate angle measurement
* LCD Display for better user experience
* Energy harvesting mechanism using solar panels
* Load power management by turning on only required peripherals
* Single rechargeable LiPo battery which can power the complete device

**Product Specifications:**

* Dimensions: TBD
* Weight: TBD
* Wireless range: 100 m
* Size accuracy: ± 1 cm
* Angle accuracy: ± 1°
* Battery Life: TBD