Project Beacon

Live Tracking of Temperature and Shock along with GPS

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Chapter 1

ABSTRACT

The industry produces temperature sensitive product which needs to be stored & transported at specific temperature only. These products, if during transportation, exposed to temperature variations & shock, and then they are rejected by the clients. A system, continuously tracking the temperature & shock is needed to ensure quality products being delivered to clients. Industry needs a temperature and shock monitoring system. The system would send the values of temperature & shock continuously to the software along-with the GPS location. GPS location would help tracking the consignment easily. A hardware is needed which would read the values of temperature & shock and will send them continuously to the software for analysis. Wireless communication between hardware unit & software.

Chapter 2

INTRODUCTION

The Beacon Package Tracker is a compact device which can be attached to any package to be tracked.

The customer/administrator will receive a link along with LOGIN ID and PASSWORD to the online dashboard on *demo.thingsboard.io*

The customer can login and view live package tracking and temperature and shock data graphs and values as intuitive graphical user interface

Beacon Package Tracker uses different sensors like GPS module, MPU6050 to acquire location coordinates, temperature and shock data respectively

This data is sent to the cloud using Wi-Fi module which is connected to the local hotspot

This data is visualize on the open source IoT platform *ThingsBoard* using *JSON* script

By the use of easily detachable add-ons extra features like display, theft detection, offline data logging and more environmental parameters

2.1 Methodology:

The complete process of tracking is basically a four step process-

1. **Acquire sensor data**
   The primary step was to gather all the sensor data i.e. temperature and shock along with geo-location coordinates (latitude and longitude values) and create a payload string. The temperature and mechanical shock was measured using MPU6050 sensor (Inertial Motion Unit) using I2C communication.

2. **Internet Access**
   The second step was to get internet access which was acquired using NODEMCU which has onboard Wi-Fi module.

3. **Push data to online cloud sever**
   After the above process the data needs to be uploaded on Thingsboard (online cloud server). For this the MQTT (Message Queuing Telemetry Transport) is used which is lightweight, the above generated payload string is continuously fired at a specific rate on the URL demo.thingsboard.io

4. **Data visualization**

Visualize the following on interactive GUI at Thingsboard: -

GPS location on Maps
Temperature History Graph
Shock Data History Graph

2.2 Objective/Problem Statement:

- The industry produces temperature sensitive product which needs to be stored & transported at specific temperature only.
- These products, if during transportation, exposed to temperature variations & shock, and then they are rejected by the clients.
- A system, continuously tracking the temperature & shock is needed to ensure quality products being delivered to clients.

Chapter 3

SYSTEM DEVELOPMENT

3.1 Block diagram and Working:

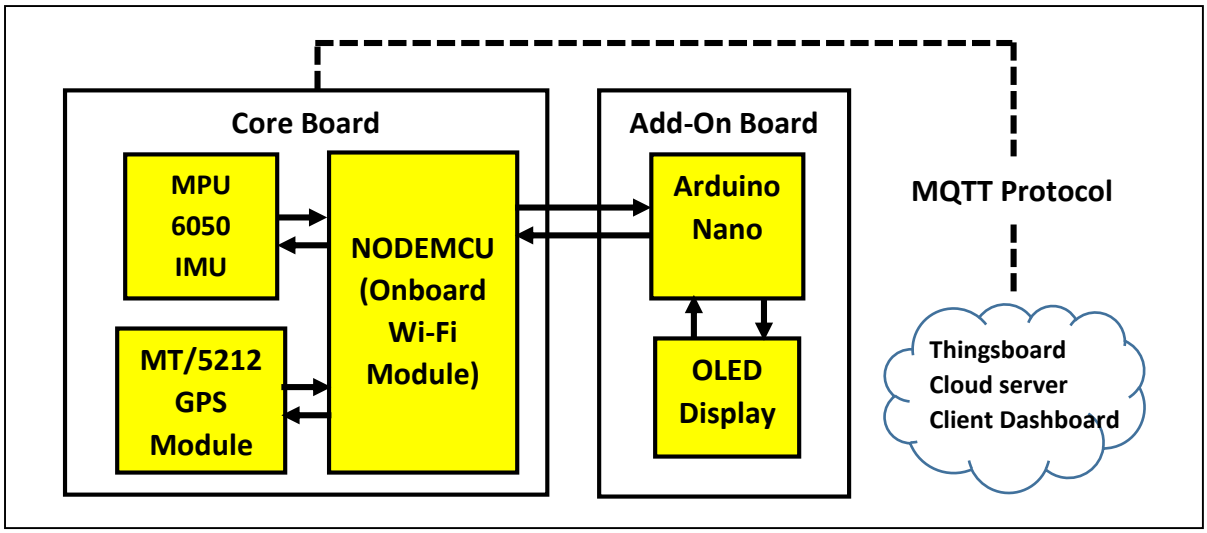

Fig. 1

Block diagram of Hardware Prototype

The block diagram as shown in fig. 1 illustrates the general working of the device. The device conations two board i.e. core board and add-on board. Both the boards are working independently and add-on board is easily detachable to save power consumption depending on the client requirements.

The MPU6050 is an IMU device (Inertial Motion Unit) which is an integrated module of accelerometer and temperature sensor and works in I2C (two-wired) communication.

The NODEMCU module has on board Wi-Fi module which is used to wirelessly connect with the internet source and access the cloud URL.

Some value addition features like- OLED display, circuit for theft detection, external memory SD card for offline data logging, etc. can be included in the add-on board.

Chapter 4

HARDWARE AND SOFTWARE

4.1 Hardware:

- NODE MCU (Arduino Nano with on-board Wi-Fi module)
- GPS Sensor (MT/5212)
- MPU6050: Temperature and IMU device
- Add-ons:

OLED display
SD card module
DS3231 RTC module
Arduino nano board
Circuit for threat detection
Other environmental parameters (using GY-80)

A) Component layout:

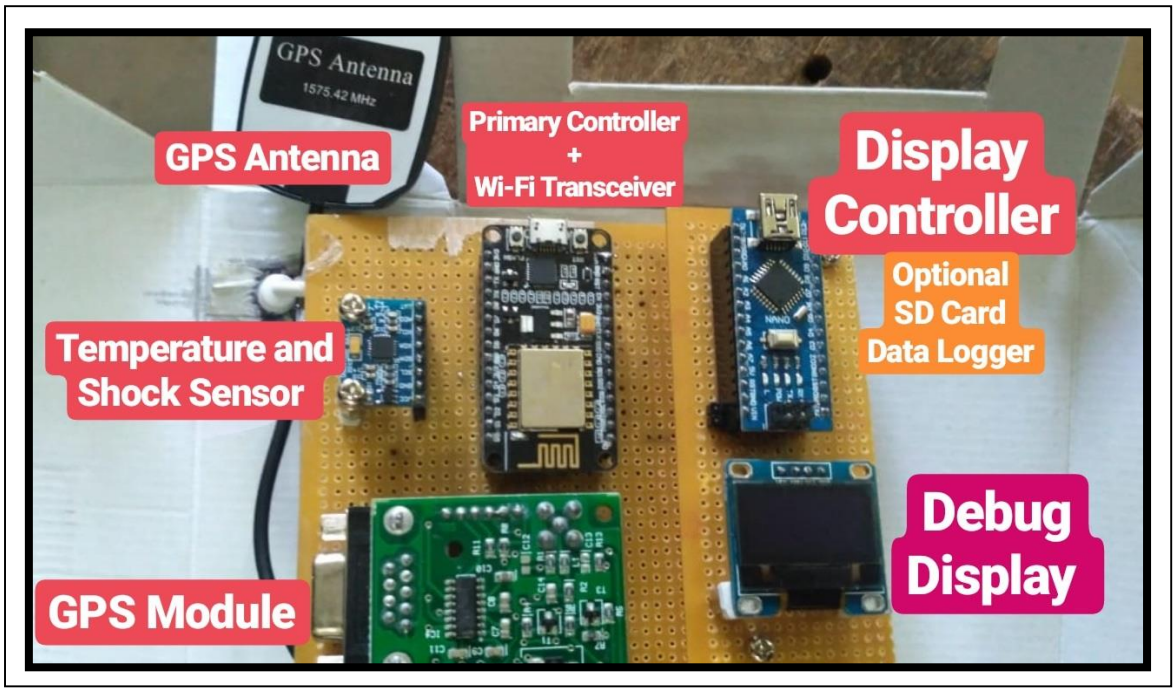

Fig. 2

Overview of Component Placement

B) PCB Layout:

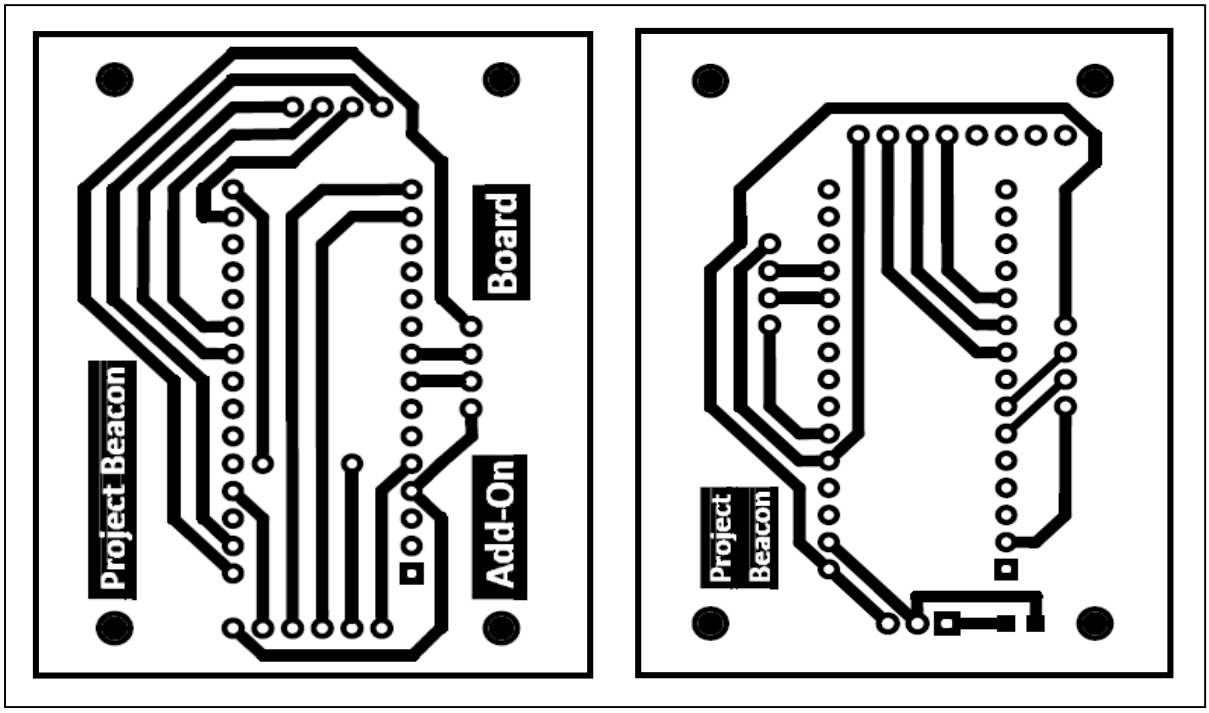

Fig. 3
Production level PCB Layout

4.2 Software:

Software used:

- Arduino IDE
- Fritzing for PCB designing
- ThingsBoard Open Source IoT Platform

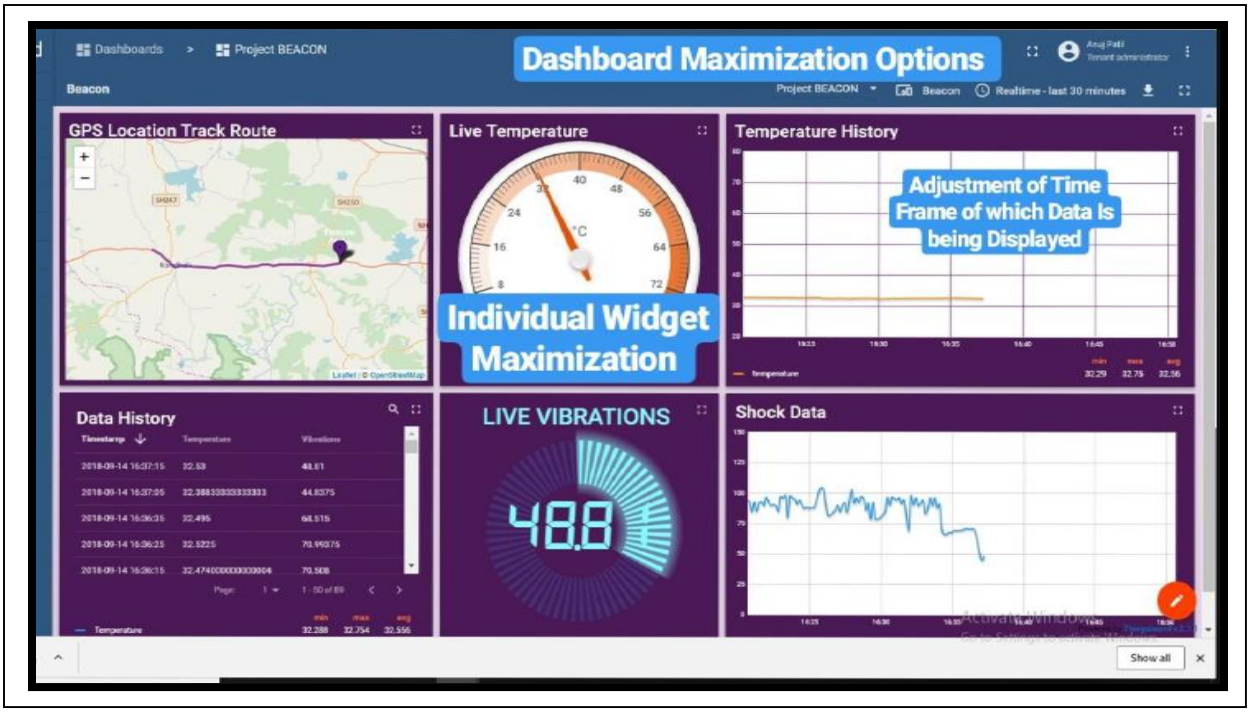

Fig. 4
Dashboard Overview

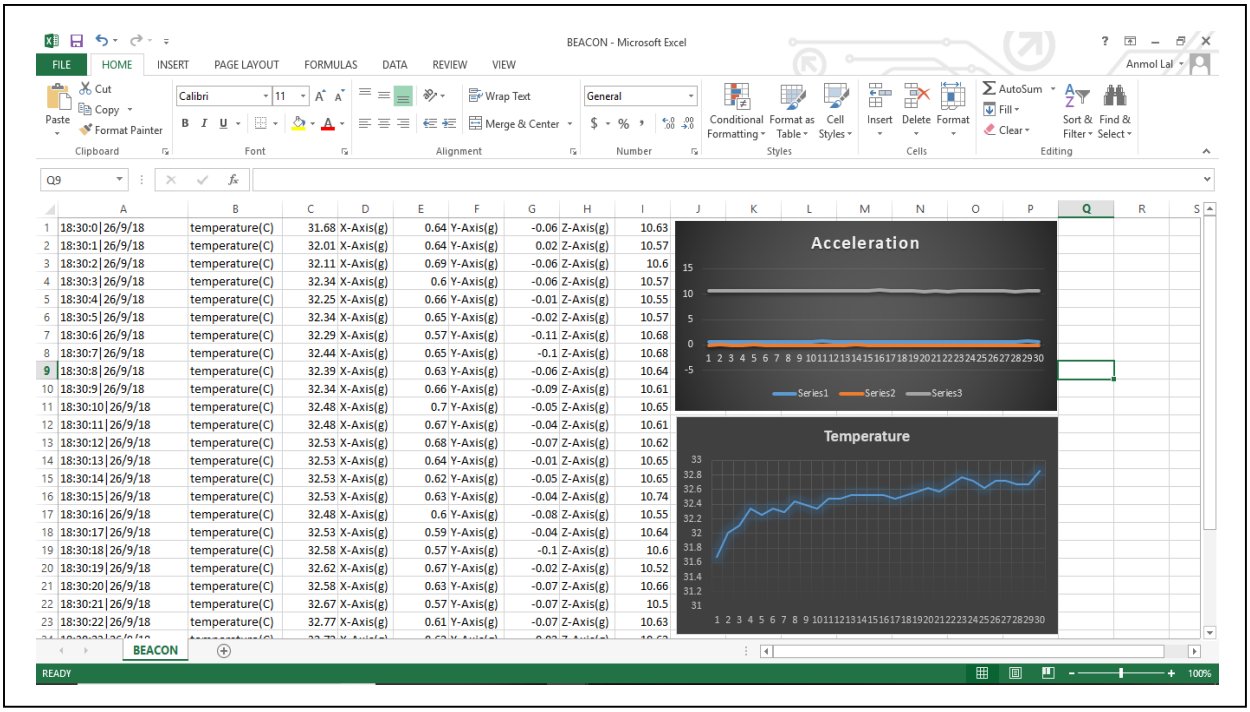

Fig. 5
Excel sheet generated from data logged offline on SD card

Chapter 5

RESULT AND PERFORMANCE

- **Extremely *convenient sharing* of data access**
- ***Intuitive Dashboards* : Way to Industry 4.0**
- ***Email Alerts/Alarms* triggered in case of fire accidents minimizing further damage**
- **With customer feedback, Machine Learning can identify the parameter variations causing damaged consignments**
- **Strong Evidence in case of Lawsuits**
- **Performance Analysis of Transporters using Condition Consistency Report**

Chapter 6

CONCLUSION

6.1 Conclusion:

The device was successfully tested on the onboard, and respective data was visualize on the created dashboard. The device worked properly throughout the testing.

6.2 Application:

According to the problem statement the device needs to work for food and beverages industries.

Apart from this the device a wide range of application, it can be used for tracking any of the industrial as well as non-industrial goods.

The various industry sectors where Project Beacon can be advantageous are Pharma industries, shipments, transportation of perishable goods, etc.

6.3 Future scope:

Though the prototype cost is comparatively much less, still the price can be enough short-cut to nearly 75% on production level. Thus the device would be inexpensive and worthy enough for use in tracking individual and cheap goods as well.

Many value addition features like offline data logging, theft detection, display unit, supplementary power supplies can be added to make device compatible to use for a week long and robust journey.

Chapter 7

REFERENCE

- https://sendum.com/pt300-package-tracker/ - Another solution for package tracking devices
- https://demo.thingsboard.io/ - URL for online cloud server
- https://indnx.in/ - Competition
- https://www.google.co.in/search?q=mpu6050+datasheet&oq=mpu6050+&aqs=chrome.2.69i57j69i60j0j35i39l2j0.10025j1j1&sourceid=chrome&ie=UTF-8 – MPU6050 Datasheet