IoTECH: Internet of Things Extensible Car Hub

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Abstract

"IoTECH", also known as the Internet of Things Extensible Car Hub, is an IoT device that interfaces with the OBD-II diagnostics port and a variety of external sensors. In an era of WiFi-enabled devices, we seek to create an IoT platform that is unique to automotive systems. This platform will allow the user to create an application that will interface with an array of sensors and communicate serially or wirelessly via Bluetooth, WiFi, and 3G data. User data is transmitted via 3G to a web server where notifications are then broadcast.

System Overview

- □ IoT platform supports multiple applications
- **Two main subsystems:**
 - IoTECH Hub server communication, car analytics, GPS data, and temp/humidity data
 - Iotect Extension motion sensor, IR camera, and gas sensor (CO, Smoke, Alcohol, etc.)
- Bluetooth Low Energy/3G data communication
- **Given Send notifications to server/mobile phone**





System Block Diagrams

Power

OBD-II Port

TECH



Signals





Specifications

Specification	Goal	Actual
Dimensions: Hub	2.5 x 2.5 x 2 in	6.25 x 3.75 x 2 in
Dimensions: Extension	5 x 2.5 x 3 in	5 x 1.75 x 3.25 in
Weight: Hub	100 g	388 g
Weight: Extension	200 g	260 g
Car Battery Life	7 days	8 days
Extension Battery Life	12+ hrs	14 hrs
Security	Encrypted Communication	Encrypted Communication

Challenges

- Send SMS/MMS texts to user via Particle Cloud, Google Cloud, Cloudinary, and Twilio.
- Server reliability multithreaded back-end Java server with Python data processing and
 - communication with IoTECH Hub
- Data transfer speed large data transfer with TCP/UDP client (e.g. camera image)
- Translate CAN to UART reverse engineer OBD-II diagnostics port reader

SDP18

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Translating Car Data CAN-to-UART

To be able to communicate with the car, we have to read data from the CAN bus. This is done by converting CAN protocol data to serial UART data, requesting for the data, translating the data from hex format, and then plugging the return values into their corresponding equations to compute values in a human-readable format.

PID	Tx (Send Cmd.)	Rx (Receive Cmd.)	Equation
Ambient Temperature	01 46	41 46 3C	A - 40 C
Coolant Temperature	01 05	41 05 7E	Value - 40
RPM	01 0C	41 0C D1 CC	Value/4
Speed	01 0D	41 0D DE	-

Example TX/RX commands to OBD-II

Applications

Software Overview





TempAlert - informs a parent or pet owner if they left their child or pet in a hot car using a PIR motion sensor, camera, and temperature/humidity sensors.

SpeedAlert - tells a parent if their child is speeding based off of the Google Maps API and GPS/speed data gathered from the car

GasAlert - sense alcohol, smoke, carbon monoxide, and other gases in a vehicle and alert users of their





presence

Cost

Part	Development	Production
Circuit Components		
(Resistors, Capacitors, Voltage Regulators)	\$31.40	\$18.74
Gas Sensor (MQ2)	\$6.90	\$5.52
Weatherproof Humidity/Temp Sensor		
(SHT10)	\$13.44	\$6.60
PIR Motion Sensor (HC-SR501)	\$1.17	\$0.91
Infrared Camera		
(LinkSprite JPEG TTL Serial)	\$49.95	\$49.95
Bluetooth Low Energy Module (HC-05)	\$3.04	\$2.99
GPS Module		
(Ultimate Breakout)	\$39.50	\$31.96
OBD-II CAN-to-UART Converter		
(STN1110, MCP2551, DB9 Connector, 16MHz Clock)	\$18.60	\$15.40
Particle Microcontrollers		
(Electron, Photon)	\$88.00	\$68.00
3D Printed Enclosures	\$4.55	\$3.54
Printed Circuit Boards		
(Extension/Hub)	\$23.70	\$0.99
Total	\$280.25	\$204.60

Text Message Thursday 4:55 PM

ALCOHOL DETECTED in your car! You are going too fast!



Today 1:21 AM

Sent from your Twilio trial account - Sent from your Twilio trial account - Here is our image!





Sample SMS Triggers from IFTTT













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