

APPENDIX – Table: Major Innovations from Nightscout

Date	Innovation^{1,2,3}	Code	Intent/Need	Features/Improvements
2/23/2013	Remote access to BG via computer	R	Real-time access to child's BG while at school	Real-time BG data available via shared Google Doc
4/2/2013	Remote access to BG via cell phone	R	Real-time access to child's BGs at school when not near the computer	BG data pushed to cell phone for real-time viewing
5/14/2013	Dexcom Connect	E, R	Ability to be farther away from system; Increased mobility	Android app that receives data from CGM transmitter and continuously pushes data to the computing cloud
6/14/2013	Smaller Android uploader	E	Increased portability	Smaller Android uploader piece attached to CGM receiver
7/16/2013	Nightscout Pebble App	E, R	Easily view real-time BG data without pulling out cell phone	Pebble watch can display real-time BG
12/11/2013	Nightscout code first openly shared	O, R	Increased collaboration and ability to have others develop and use the Nightscout code	Initial Nightscout code shared via Twitter ⁴
1/13/2014	Moto G4 capability	E	Android phone for remotely accessing BG levels can be costly	Ability to use a cheaper, non-contracted network phone
2/20/2014	Nightscout Pebble App 2.0	D, E	Actionable steps recommended based on BG levels	Pebble watch app incorporates DIYPS algorithm which evaluates BG trends and provides treatment recommendations
2/28/2014	Nightscout code published	O, R	Increased collaboration and ability to have others develop and use the Nightscout code	Nightscout code made available open source on GitHub
3/26/2014	Updated Nightscout web interface with colors	V	At-a-glance visualization of BG data and trends	Colors assigned for low (red), in-range (green), and high (yellow) BGs
7/31/2014	Nightscout Software Release (“Alpha”), Version 0.3.0	I, V	Display BG levels in millimoles (mmol/l) for international users	Integrated support for BG readings in mmol/l
		V	Reduced contrast display for viewing BG levels at night	“Night Mode” option that automatically dims the page from 10pm to 6am
		V	Easily see BG number at a glance on smartphone	Mobile-friendly user interface with larger BG number
		U	Quick access to features and settings	New toolbar with buttons to test alarm volume and open Settings menu
		S, V	Indications to easily determine if data have stopped updating	“Stale data” indicators to denote when data have not updated in 10 minutes (background of the timestamp changes to yellow) or 20 minutes (background

¹ GitHub Inc. CGM-Remote-Monitor. San Francisco: GitHub; c2019 [2019 Sept 11]. Available from: <https://github.com/nightscout/cgm-remote-monitor/releases>.

² The Nightscout Project. Nightscout Site Features. [2019 Sept 11]. Available from: <http://www.nightscout.info/wp-content/uploads/2015/09/NS-sitefeatures-timeline-092015.pdf>.

³ Nightscout. wearenotwaiting Documentation. 2018. [2019 Sept 11].

⁴ Costik, John (jcostik). “Want to get data from a G4? goo.gl/iU4Dpi w/ an abundance of caution, I’ll be taking it slow, but I will do what I can:) #diabetes” 11 Dec 2013, 11:10 a.m. Twitter. [2019 Sept 11].

				of timestamp turns red and BG number gets a line through it)
		U	Ability to personalize Nightscout website	Option to create a custom title for Nightscout site
9/10/2014	Nightscout Software Release (“Brownie”), Versions 0.4.0 - 0.4.3	S, V	More easily spot important information	Default grayscale theme with colors only used to indicate key information (e.g., out of range BGs, errors, etc.); “Colors” theme option if user prefers full-color display ⁵
		V	Easily view status of uploader battery on Pebble watch	Uploader battery display for the Pebble watch face
		S	Notifications for CGM issues	Display of CGM error codes
		D, V	More detailed information about predicted BG values	Confidence interval cone displays the predicted range of BG using Nightscout algorithm based on 90% confidence interval (rather than the previous single predictor line)
		C, P	Ability to receive notifications about updates to Nightscout Care Portal across devices	Pushover service to push messages to phone, Pebble watch, and desktop when there is an update to Care Portal
		V	Enhanced data visualization	LOW/HIGH labels displayed (like Dexcom) when BG values are below 40mg/dl or above 400mg/dl
11/6/2014	Nightscout Software Release (“Cookie Monster”), Versions 0.5.0 - 0.5.1	V	Enhanced data visualization	LOW/HIGH labels displayed for mmol/l (below 2.2 mmol/l or above 22.2 mmol/l)
		P, V	Easily view calibration data	BG values from CGM calibrations displayed on chart (larger dots on graph); Pushover notifications for when meter BGs are entered as calibrations
		E	Issues with Mongo database performance	Indexes on key fields to improve performance for large databases
		I	24-hr time display for international users	Option to display as 24-hr time
12/21/2014	xDrip syncing to Nightscout	E, R	Ability to view data from xDrip on Nightscout website	xDrip, an Android app in combination with a wixel (a DIY CGM receiver) that receives data from Dexcom G4 sensor/transmitter and allows the data to be viewed on an Android phone, is able to feed to a user’s Nightscout database
1/13/2015	Nightscout Software Release (“Dreamsicle”), Versions 0.6.0 - 0.6.4	S, U	Ability to adjust/ personalize alarm settings	Customizable BG thresholds (for low, urgent low, high, urgent high) and alarm settings
		V	Easily view how much the BG has risen or fallen since the last value	Display BG changes (deltas) from the previous recorded BG value
		C	Ability to enter additional contextual information in Care Portal	Options added to Care Portal for backdating treatment events and documenting pre-bolus activities (e.g.,

⁵ Desborough L. Color Choices for Nightscout: Subdued is Safer: Nightscout; c2014 [2019 Sept 11]. Available from: <http://nightscout.github.io/posts/colors-subdued-is-safer>.

				grams of carbs consumed, amount of insulin given, timing of dose)
		C, V	Easily view Care Portal treatment events on graph	Addition of large dots on graph to denote treatment events from Care Portal (e.g., if a bolus event, the grams of carbs eaten, and units of insulin given are also displayed)
		C, V	Easily view notes associated with data points when viewing graph	Ability to hover over data points and see associated notes from Care Portal (e.g., time, treatment type, carbs, insulin, BG, person who entered the treatment in Care Portal)
		D, V	Access to BG data during sensor warmup and calibration	Enabled raw data access
1/19/2015	Nightscout Uploader for Medtronic Sensor (“MMCommander”)	R	Ability to see data remotely from the Medtronic Enlite CGM sensor	Medtronic Enlite CGM data accessible via Nightscout website (available features/display based on “Brownie” version)
1/20/2015	Pebble Split Screen App	E, V	Ability to see BG levels for two individuals with diabetes at one time on a Pebble watch	New Pebble app to view data from two Nightscout servers on a single watch face (later called “Nightscout Duo”)
4/19/2015	Nightscout Software Release (“Enchilada”), Version 0.7.0	C, V	Track how much insulin has yet to be distributed	Displays insulin-on-board (IOB) based off of Nightscout Care Portal entries and a user-defined treatment profile
		V	Visualize noise level (sensor signal variability can be due to factors like sensor compression or dehydration)	Visual indicator of noise level added (e.g., light noise depicted as a grey box around current BG, medium noise with a yellow box, heavy noise/error with a red box)
		S	Alert if data have not updated for a certain amount of time	Alarm added for "stale" data
9/3/2015	Nightscout Software Release (“Funnel Cake”), Versions 0.8.0 - 0.8.4	S	Notifications based on predicted BG levels	Alarms can be triggered by Nightscout-predicted BG levels (in addition to actual/current BG levels)
		U	Ability to create/edit custom treatment profile	New treatment profile editor makes it easy to create/edit custom profiles that contain information (e.g., insulin doses, target BG) that other features rely on
		C, S	Track amount of time since insulin pump site was changed	Cannula Age (CAGE) indicator added based on Care Portal data and user-defined treatment profile
		V	Easily view current basal rate	Basal rate indicator added to display current basal rate based on user treatment profile; Basal rates also charted on graph
		C, V	Track temp basal rates	Option to enter temp basal rates in Care Portal; Temp basal adjustments also displayed on graph
		C, D	A tool for providing decision support based on the relationship between current BG and IOB	Bolus Wizard Preview (BWP) snoozes high BG alarms when there is enough IOB, calculates bolus correction amount when above target, suggests temporary

				basal rates and carb corrections, and alerts the user to consider testing and correcting when BG is moving out of ideal range; BWP is dependent on information entered into Care Portal and user treatment profile
		E, R	Ability to use Dexcom Share data	For iOS users paired with Dexcom Share, integrated Share2Nightscout Bridge displays Dexcom Share data on Nightscout site
		E, R	Ability to use MiniMed Connect data	For iOS / Medtronic users, integrated MMConnect Bridge displays Enlite CGM and general MiniMed insulin pump data on Nightscout site
		U	Ability to create custom actions following an “if this, then that” logic	IFTTT integration allows users to create their own recipes using any available IFTTT channel in combination with the Maker channel (e.g., sending an SMS message in the event of a low BG warning)
		I	Language translation for international users	Support for 14 languages
		C, V	Track exercise alongside BG and insulin data	Ability to enter exercise events in Care Portal; Exercise events displayed as purple blocks on graph
11/18/2015	Nightscouter 1.0 App for Apple iOS Devices	E, V	Ability to view BG data from Nightscout on Apple iOS devices	iOS app retrieves data from existing Nightscout websites and allows users to view CGM data on iOS devices
11/29/2015	Color Pebble Watch Face	E, V	New Pebble watch face designs in color	Full-color watch face design for Pebble watches with color screens
1/4/2016	NightGuard App for Apple iOS and Apple Watch	E, V	Ability to view BG data from Nightscout on Apple iOS devices and Apple Watch	iOS app with support for Apple Watch that displays BG values from Nightscout and alerts when values are out of customizable range (originally released as “ScoutWatch”)
1/6/2016	URCHIN CGM Pebble Watch Face	E, U, V	Ability to view BG values alongside a graph on a Pebble watch	The “Unopinionated, Ridiculously Configurable Human Interface to Nightscout” (URCHIN CGM) watch face allows users to view current BG, graph of BG data, and customizable options if available on user’s Nightscout (e.g., pump data, predictions, etc.)
10/14/2016	Nightscout Software Release (“Grilled Cheese”), Versions 0.9.0 - 0.9.2	E, U	Simplified set-up process when creating a Nightscout site	“Deploy to Azure” button (or “Deploy to Heroku”) allows users to more easily make configuration choices when creating a site for the first time
		C, S	Track the amount of time since the last insulin cartridge change	Insulin Age (IAGE) tracks the days/hours since the last insulin cartridge change treatment recorded in Care Portal
		C, S	Track the amount of time since the sensor was placed or started	Sensor Age (SAGE) tracks the days/hours since the last CGM Sensor Start and CGM Sensor Insert treatment recorded in Care Portal

		C, D	Easily calculate bolus dose based on all available information	Bolus calculator (Bolus Wizard) plugin calculates bolus insulin amount based on available data including amount of carbs to be consumed, IOB, carbohydrates on board (COB), and current BG
		U	Store information about commonly eaten foods	Plugin that allows users to save entries for commonly eaten foods for use with Bolus Wizard
		C, V	Track “combo bolus” treatment events	Option to enter combo boluses (part of bolus dose is given initially, part is delayed over a period of time) in Care Portal; Combo boluses also displayed on graph
		C, S, U	Ability to control who can update or view data on Nightscout site	Token/role-based authorization to create limited-use roles and edit rights (e.g., allow a caregiver to see the site data, but not make Care Portal treatment entries; allow a caregiver the ability to see the site and make Care Portal entries; allow a caregiver total access to see the site, make entries, and use admin tools; or turn off access to users by removing their tokens)
		E, V	Ability to integrate insulin pump information into Nightscout site	Integrated insulin pump monitoring available via Nightscout for OpenAPS, MiniMed Connect, RileyLink, and t:slim; Alerts for percentage of pump battery remaining, number of units of insulin remaining in the pump, and IOB (directly from the pump rather than from a Care Portal entry)
		AP, V	Ability to monitor OpenAPS and Loop (DIY artificial pancreas systems) in Nightscout	Integrated OpenAPS and Loop monitoring including alerts when system is not ‘looping’ and additional display fields (e.g., OpenAPS status)
		E, S	Support for multiple active CGM uploaders	Ability to combine data from multiple CGM uploaders into a single Nightscout site (including alerts for all battery levels)
		P, U	Reduce/streamline the number of alerts and notifications	Option to create alarm/notification groups
		U, V	Track basal/bolus/carb stats over time	Quick access to basal/bolus/carb stats in a day-to-day report
		C	Ability to move/delete treatment entries	“Edit Mode” added to Care Portal
		I	Additional language support for international users	Additional translations to support a total of 20 languages
		U	Access to BG data when hands are not free	Amazon Alexa integration that can recite BG value
9/22/2017	Nightscout Software Release (“Habanero”),	E	Support for users with limited mobile data	Site loading/usage requires less data consumption
		E	Speed improvements	Better browser compatibility and faster loading speeds

	Versions 0.10.0 - 0.10.3	D, U	More accurate glucose data for retrospective review	“Distribution” report filters CGM data for noise and shows additional glucose variability analysis ⁶
	(Versions 0.10.1 - 0.10.3 named “Habanero Yellow,” “Habanero Red” & “Habanero Purple,” respectively)	U, V	Track total daily COB and IOB	Visualization of total COB and IOB added to daily reports
		I	Language translation for international users	Support for Simplified and Traditional Chinese
		AP, V	Additional support for monitoring DIY closed-loop systems	Improvements to OpenAPS, Loop, and AndroidAPS data visualization & compatibility (e.g., BG graph displays predicted glucose values from both the Nightscout algorithm as well as the OpenAPS algorithm)
		U	Calculate total basal insulin dose	Total daily basal insulin dose can be calculated based on data entered in user’s treatment profile
		U	Audio support for those who are unable to view the site on a screen	Speech plugin added to read out the blood glucose values, IOB, and alarms
		U	Support for colorblind users	‘Colorblindfriendly’ theme option
		S, V	Track the time since insulin pump batteries were last changed	Battery age (BAGE) indicator added
2/7/2019	Nightscout Software Release (“Ice Cream”), Versions 0.11.0 - 0.11.1	E, S	Secure access to Nightscout website	Redirect HTTP to HTTPS and implemented HTTP Strict Transport Security (HSTS); Unsecure access via HTTP is no longer allowed, by default
		D, U, V	Additional reporting features for users of DIY closed-loop systems	Day-to-day report shows glucose predictions for users of OpenAPS, Loop, and AndroidAPS (visual tool for helping with adjustments to insulin dose ratios)
		AP, D, U, V	Visualization of Loop data to better understand how the system is working	“Loopalyzer” report displays daily graphs of basal profile, glucose, automatic temporary basal changes, IOB, and COB
		C, E	Track when CGM sensor has been stopped	“CGM sensor stop” added to Care Portal as a treatment event option
		I	Language translation for international users	Japanese and Turkish translations added

⁶ Loop Tips. Nightscout. [2019 Sept 11]. Available from: <https://kdisimone.github.io/looptips/data/nightscout/#nightscout-reports>.

CODE KEY:

AP=Artificial Pancreas

C=Care Portal Support

D=Decision Support

E=Equipment Improvements

I=International Support

O=Open-source Collaboration

P=Pushover Notifications

R=Remote Monitoring

S=Safety

U=User Experience Improvements

V=Visualization Improvements