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DYNAMIC CODE UPDATE FOR THE EFFICIENT USAGE OF STREET LIGHT APPLICATION

Chandana P[1], N Sheela[2]
[2]Assistant Professor, [1,2]Department of Computer Science and Engineering,
JSS Science and Technological University, Mysuru, India

Abstract: Internet of Things (IoT) is a community of connected physical objects that are reachable through the internet. The 'thing' in IoT could be a person with a soul monitor or an automobile with built-in-sensors, i.e. objects that have been authorized with IP address and have the capacity to gather and relocate the data over a network without manual assistance or intervention. Project objective is to update the code dynamically for usage of street light efficiently. To predict the consumption of light using previous recorded values and predicting using linear regression method. This project proposes the idea of live code updates for IoT devices in the street light. Linear regression algorithm is used to predict the consumption of street light using recorded values. Population, number of houses, industries and month values are recorded and consumption of light for that particular area is predicted. Automatic changing of light intensity according to seasons and distribution of light using pulse width modulation techniques are proposed. Problems are avoided by updating the code image in-place through binary byte code; while the code is live and still executing. Can be used in applications where all dynamic code update is needed. Changes can be made easily according to the requirement of the users. Code modification done at development side and compiled version of the modified code will be updated to cloud and same sent to the operational environment for new changes to affect themselves. Using live code we have given two line voltages. According to the requirements we can change the values which avoids going to a particular line and changing it.

I. INTRODUCTION

Internet of Things (IoT) is an ecosystem of connected physical objects that are accessible through the internet. The 'thing' in IoT could be a person with a heart monitor or an automobile with built-in-sensors, i.e. objects that have been assigned an IP address and have the ability to collect and transfer data over a network without manual assistance or intervention. The embedded technology in the objects helps them to interact with internal states or the external environment, which in turn affects the decisions taken. The Internet of Things (IoT) is a novel computing paradigm that couples sensing devices, computing nodes, communication devices with various types of objects in physical world for data collection, exchange, and remote control. IoT devices often have very tight constraints on cost, form factor, and power/energy consumption. This project proposes novel strategies to update deployed code for IoT devices with the prototype of street light application based on live code updating technique and linear regression method. Automatic changing of light intensity and distribution of light using pulse width modulation techniques are proposed for street light application. Raspberry Pi 3 is used to use the different ranges of voltages. Project objective is to update the code dynamically for usage of street light efficiently. To predict the consumption of light using previous recorded values and predicting using linear regression method. Automatic on and off of light is carried out according to the time zone. Efficiency is carried out in street light like automation is done so that going to particular line is avoided, time consumption will be also reduced, changes are also made easily to the street light. If the particular light is not on using sensor values they can be viewed and do the changes accordingly. If the street light is not on message is delivered to lineman automatically. User can specify requirements to the user by sending mail to the developer team. Updated code will be sent from cloud to raspberry pi and particular changes of values will be updated and shown on street light model.

II. PROPOSED METHOD

This project proposes the idea of live code updates for IoT devices in the street light.

Features of proposed system are:

- To predict the consumption of street light using linear regression algorithm.
- Automatic changes in voltages by passing two line voltage using pulse width modulation technique.
- Automatic on and off of street light according to timings.
- Automatic change in intensity value of street light according to the time or requirement.
- User can send the requirements to the developers by mail and particular line man or in charge to that particular area will get notifications if street light not on the required time.

Details to the features listed above are explained below. Linear regression [6] algorithm is used to predict the consumption of street light using recorded values. Population, number of houses, industries and month values are recorded and consumption of light for that particular area is predicted. Automatic changing of light intensity and distribution of light using pulse width modulation techniques are proposed. Problems are avoided by updating the code image in-place through binary byte code; while the code is live and still executing. Can be used in applications where all dynamic code update [1] is needed. In-place code needs to handle the situation that code being updated could be live

and actively executing Changes can be made easily according to the requirement of the users. Code modification done at development side and compiled version of the modified code will be updated to cloud and same sent to the operational environment for new changes to affect themselves. Using live code we have given two line voltages [2]. According to the requirements we can change the values which avoids going to a particular line and changing it.

III. MODULE FUNCTIONALITY

Developer

Developer receives the user requirements. They will view the existing code and update that code according to the user requirement. By logging into the cloud, they will upload the new updated code.

System Unit

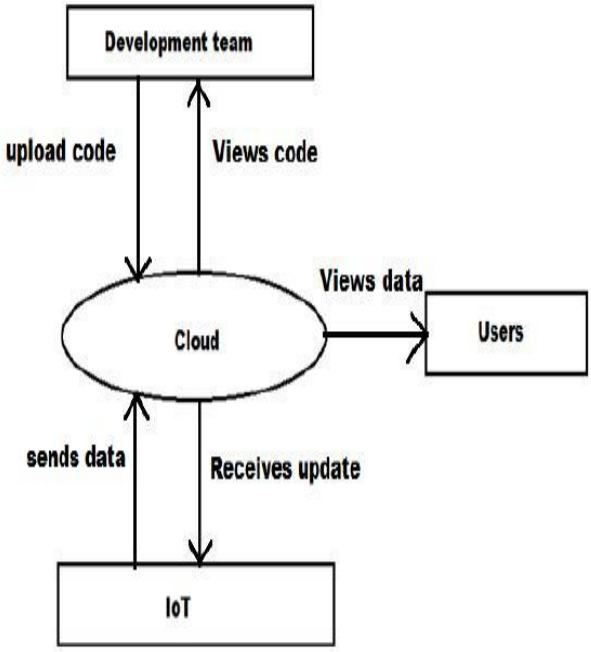
It checks for the updated code. It downloads the updated code and will run that updated code to get the expected outcome.

User

They give requirements to be made. They receive the sensor values of the street light. They will get the notifications like alert messages.

Street Light

Sensors present in the street light receives the values and give outcome accordingly. Variations in the voltages are done using pulse width modulation technique [5] and intensity are done for street light using live code update technique [3]. Automatic on and off of the street light is done. Prediction of consumption of street light is predicted using linear regression [7] algorithm.



Above data flow diagram shows different modules and its functionalities.

IV. IMPLEMENTATION

Functionalities implemented are:

- Consumption of street light is predicted using linear regression algorithm.
- Automatic changes in voltages by passing two line voltage using pulse width modulation technique.
- Automatic on and off of street light according to timings using java functions.
- Automatic change in intensity value of street light according to the time or requirement using java functions.
- User can send the requirements to the developers by mail.
- Messages are delivered to the particular line man or in charge to that particular area will, if street light is not on the required time using android functions and light dependent resistor.

All the above listed functionalities with methods are explained below.

Linear regression is a statistical approach for modelling relationship between a dependent variable with a given set of independent variables. Simple linear regression is an approach for predicting a response using a single feature. It is assumed that the two variables are linearly related. Hence, we try to find a linear function that predicts the response value(y) as accurately as possible as a function of the feature or independent variable(x).

Consider a dataset with p features (or independent variables) and one response (or dependent variable). Also, the dataset contains n rows/observations. We define:

X (feature matrix) = a matrix of size n X p

Where X_{ij} denotes the values of jth feature for ith observation

So, (X_{11} …X_{1P}, X_{21} ..X_{2P}, X_{N1} ..X_{NP})

And y (response vector) = a vector of size n where Y{i} denotes the value of response for ith observation.

$Y= (Y_1,Y_2…Y_N)$

The regression line for p features is represented as $H(X_I)=\beta_0+\beta_1X_{i1}+\beta_2X_{i2}+..+\beta_PX_{IP}$

where h(x_i) is predicted response value for ith observation and b_0, b_1, …, b_p are the regression coefficients.

Also, we can write:

$Y_i= \beta_0+ \beta_1X_{i1}+ \beta_2X_{i2}+..+ \beta_pX_{ip}+€_i$

Where e_i represents residual error in ith observation. We can generalize our linear model a little bit more by representing feature matrix X as:

$X= (1..1,X_{11}..X_{n1},..X_{1p}..X_{np})$ So now, the linear model can be expressed in terms of matrices as:

$y=X\beta+€$

Where $\beta=(\beta_0, \beta_1…\beta_p)$ and $€= (€_0, €_1…€_n)$

Now, we determine estimate of b, i.e. b' using Least Squares method.

As already explained, Least Squares method tends to determine b' for which total residual error is minimized.

We present the result directly here:

$\beta^ =(X^1X)^{-1}X^1y$

Where β^ represents the transpose of the matrix while -1

represents the matrix inverse.
Knowing the least square estimates, b', the multiple linear regression model can now be estimated as:
Y^=X β^ where y' is estimated response vector.
User will specify requirements to the developer. Developer uses linear regression algorithm to predict the consumption of street light. Voltages are given to two line using pulse width modulation technique and distribution is made using raspberry pi 3 and shown in model. Pulse width modulation is a modulation technique used to encode a message into a pulsing signal. Its main use is to allow the control of the power supplied to electrical devices. [10] The average value of voltage fed to the load is controlled by turning the switch on and off at a fast rate. The longer the switch is on compared to the off periods, the higher the total power supplied to the load.
Live code updating technique [9] is used to implement the required outcome i.e. the code for different functionalities of street light like automatic on and off of street light in morning and evening and passing different voltages and intensity. Changing intensity of light according to the timings. Live code technique means updating the code image in-place through binary byte code; while the code is live and still executing. Can be used in applications where all dynamic code update is needed. In-place code needs to handle the situation that code being updated could be live and actively executing Changes can be made easily according to the requirement of the users. Code modification done at development side and compiled version of the modified code will be updated to cloud and same sent to the operational environment for new changes to affect themselves. Using live code we have given two line voltages. According to the requirements we can change the values which avoids going to a particular line and changing it.
Automatic on and off of the street light is done using calendar function in java. According to time zone it will automatically on and off and if light is not on they can know from the sensors and will make required changes to be done. Like in morning after 5'o clock intensity of light will be decreased and at 6'o clock it will get automatically off. And in evening at 6'o clock light will automatically on and intensity will be less and it will get increased after
7'o clock, means at 6'o clock intensity will be 1, at 7'o clock it will automatically changes to 2.the intensity value can be changed according to the requirement. This will avoid going to all the lines for on and off of the street light and defects in the light can be known easily. Code is updated using live code update technique. Automatic message is delivered to line man or particular in charge of the street light, if the street light is not on required time. This process is done using sensor known as LDR (Light Dependent Resistor) and android application is used to deliver message by generating tokens.an LDR is a component that has a resistance that changes with the light intensity that falls upon it. This allows them to be used in light sensing circuits. LDR is used to automatically turn on a light at a certain light level. Using android studio functions and generating tokens messages are sent to the given phone number when the street light is not on which is detected by light dependent resistor sensor.
Two line loads are set to the required functionalities to be shown.to pass the values to the raspberry pi, gpio controller instances are created along with pins to create a way to get the input values. Some default value of range and clock will be set. After all the process gpio controller instances will be shut down.
Monitoring is also done using graph which displays amount of voltage passed by running the program and raising the request to the developers for different functionalities or changes to be made in voltages by sending mail to the developers.
Updated code will be generated and live code will be sent to the cloud. From cloud the amount of light will be given to hardware component raspberry pi and will be shown on the model.All the connections to the raspberry pi should be made like power supply, monitor and other. Then command. /pi4j IoT server should be run in order to get the result in model.

V. CONCLUSION

Consumption of street light is predicted using linear regression algorithm which uses historical values to predict the consumption of street light. Using live code technique we have given two line voltages. According to the requirements we can change the voltage values using pulse width modulation method. Automatic on and off of street light according to the time is done which avoids going to the particular line and doing it. Variations in intensity of light according to the time and requirement is carried out. When there is a start of new area, they can predict the consumption of light and can provide the required amount of light.

VI. FUTURE ENHANCEMENT

Extending code updating to different applications like automating bill for consumption of water, light. Etc. Adding some more features to street light like changing the voltage or intensity of light according to the seasons, during rainy time to do some careful measures to give light to the user without any intervention. Extending for reducing the memory required. Extends to use any other efficient method for the usage of street light.

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