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Testing Fuzzy Logic Street Light System using Uppaal

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Abstract:- Vitality emergencies are one of the most serious issue of Pakistan since 2009. It's gaining out of power step by step, which caused by numerous reasons and with the assistance of our examination street light is one of the greatest reasons and its numbness drove our nation to the vitality emergencies. It can take 40% to 60% power of single city of all-around created nation and if it's not controlled appropriately it can cause much more. Human life turns out to be excessively occupied and incapable making it impossible to discover time for manual exchanging framework at whatever point its vital. So, we go to the arrangement and composed our own model called automated model of street light using fuzzy logic however with the help of this model we can control the street lights system which keeps the wastage of energy and road accidents occurs due to bad light during day time. Utilizing and testing this method and logic in Uppaal tool for testing, we can save huge measure of vitality which assists us with solving vitality emergencies without utilizing any huge energy spending.

Keywords:- *Automation of Street Lights; Fuzzy Logic; Uppaal; Software Testing.*

I. INTRODUCTION

Computerization of Street Lights System are receiving by the little and enormous Cities quickly around the globe and making it more efficient with different proposed methods by students and technologist with automated frameworks. The tremendous measure of road accidents happened because of manual on off catch for manual switching the street lights and it additionally by one means or another making it excessively mind boggling and exorbitant, making it impossible for people in general to drive protected and secure amid the night time, So we proposed effective model created by us and make the street light framework more productive with the help of fuzzy logic and testing the it in any test tool for pre verification results of our fuzzy logic model So it can be useful to avoid the car accidents in bad light during the day time caused by the bad weather. This paper can be referred to the soft computing and it counterfactual the prototype model where the accurate values will not deliver quickly and with the partial truth values we will be able to conduct the good tests and review for this model.

In any case, there are some great and modernistic examination apparatuses use and control by the analyzers universally. One the great constant check instrument is Uppaal [1], originated by the Uppsala and AALborg Universities. This measuring tool is especially backing the automatic check of the immunity and fenced aliveness properties of real-time frameworks or systems [2]. A well measure of contextual analyses has done [3-7] on the modules and utilizations of hardware in Uppaal. Nevertheless, in an extensive bit of the relevant examinations, the arranged automata models are developed physically, which infers the models are worked by the fashioners in light of the appreciation to the program. In this way, the programming messes up and non-correspondence between system plan and execution won't be anchored. As demonstrated by [8], the correspondence of the bona fide structure and the model has advanced toward turning into an important issue of current affirmation show improvement. In this paper, we proposed our model and customized it in the UPPAAL for test and review the entire model and with the help of the results shown by this analyzer tool it can further proceeds to the practical life.

A question arranged programming tongue is picked, and a compiler-based instruments are executed to pares the source code and straight forwardly make the arranged automatism show. Some prosperity and aliveness properties of the program can be checked by the UPPAAL verifier.

Whereas, according to, Fuzzy logic model is used to process vague and imprecise information that cannot be computed in any other estimation model. It is often used as machine learning tool that reads and computes human behavior as input, converts this crisp information in a process called fuzzification. Fuzzy logic uses the fuzzy set theory that is the extension of classical set theory where the membership of an element x of a classical set A, as subset of the universe X [9].

This framework has its own limitations. This method does not need special training, dependable estimation and its flexibility yet is not easy to use rest its cost estimation of complex features is repetitive [9]. Figure 1 represents the Fuzzy Logic Model.

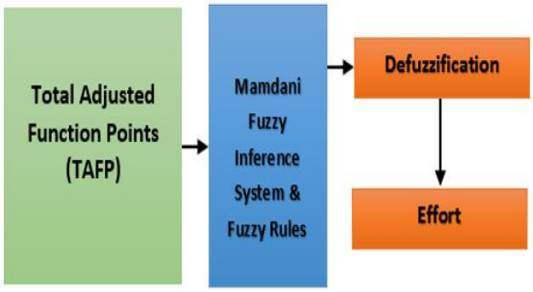

Fig 1:- Fuzzy Logic Model

II. LITERATURE REVIEW

We examine a considerable measure of Research paper from around the world, every nation is following their own Street Light Systems since they have their own issues and significant motivations to spare or waste Energy. Nation like France and Japan their urban areas Paris and Tokyo are popular for calling city of lights on the planet as a result of their street light system. [10] Various answers for control the road lighting are met by and by.

The present pattern is the presentation of mechanization and remote Management answers for control road lighting [11]. Remote administration frameworks with mechanization innovation permit control of lights, alteration of light levels, and light or parts blame reports. Notwithstanding the vitality sparing focal points, the alteration of light levels adds to the decrease of light contamination [12].

III. RESEARCH METHODOLOGY

Concentrate the Literature survey and Problem framework we accompanied various difficulties. We have completed lots of Paper work and gatherings to take care of every one of those issue one by one which are included below.

A. Control Lights by Time

We have personally visited the many sites into the cities and out of the stations to examine some automatic streets lights currently being functional on the roads by the government and private companies. We found that these Models are being controlled by the microcontroller with help of time. The program has been deployed into the microcontroller where it should turn On and Off the street lights by given conditions in the program i.e. that is on every single day at 6pm the lights will be turn on and it will off at 6am it can surly benefit the users by making it automatically turning on and off however this program or system cannot work into the bad lights occurred by the weather during the day time which led to the road accidents.

B. Solar based Street Lights

We found some solar based street lights system deployed in city and out of the city, this solar based system is automatic and it self-charged where it can benefit from consuming a huge amount of energy. It has also automating turn off and off system by giving the time conditions into the microcontroller as we mentioned above, nevertheless this system is redundant expensive and its deployed on single street light which can take ages to cover the whole city or the main highways and it take manual maintenance after the one year of time it being deployed to the roads which make it more expensive and uneconomical.

Our Aim to give one best framework to Street lights where the administration and individuals can get advantage from it and it will be founded on our answers which we achieved after a considerable measure of diligent work. Those are:

- Highly Efficient
- Cost Effective
- Low tedious

➢ *Profoundly Efficient*

One of our answer is that our task will be the Highly Intelligent that it won't require any sort of Manual guideline from the outsider or client. It will be Control with the assistance of C dialect program and it will gain from its earlier information source from sun it will turn on the lights with help of dark sensor even in daytime occurred by the bad weather and it will wait for the time (which will be different every night with help of "Fuzzy Logic ".

➢ *Fuzzy Logic*

There are huge amount of definitions, Examples and tutorials about fuzzy logic that what is the fuzzy logic and how it works. We are not going to describe any pre-written definitions but will make our own to describe it in very easy words and sentences with the help of examples.

Basically, fuzzy logic is the mid value of any Boolean values i.e. If there is 0 and 1 the fuzzy logic will be the mid value between 0 and 1 however the value still can be unknown for example it can 0.34 or it can be 0.76 that make fuzzy logic more interesting than anything.

We have used fuzzy logic in our model to make it more efficient than current models are implemented on the roads. When our model detect the dark it will turn on lights as we have programed it to do so where time will be eventually 7:00pm according to my city however in different countries there will be the different time for the twilight, after turning on the lights will be continually on till the traffic on the roads will get vanish perhaps traffic will get low at 11:00 or next day it will get low at 10:00 it depends on the season. If there are the summers the traffics mostly get low at 1:00am to 2:00pm and in winters traffic will get low at 10:00pm to 11:00pm due to fact that our model will get the random average value of the time to make the lights dim. It will make the lights dim at 11:00pm during the winter season and at 1:30am in the summers with the help of the fuzzy logic however the value is still unknown. That's where our model uses the fuzzy logic when it makes the lights dim.

We have outlined cascade technique for Automation Street light System utilizing fluffy rationale and we have guided the stages for grab accomplish what we are on to. We have classified it into 6 stages, as should be obvious into the figure.2

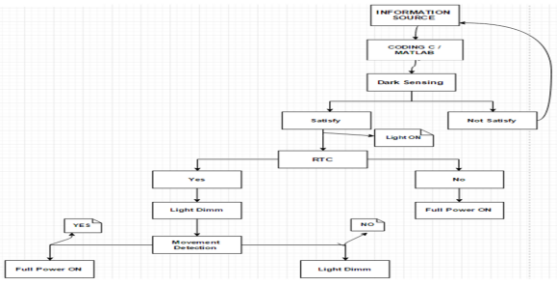

Fig 2:- Working method of Prototype

The work will be done in C Programing Language. We will enter the accompanying parameters with the assistance of sensors and then it will move further to the lights on and to the fuzzy time to make it turn dim.

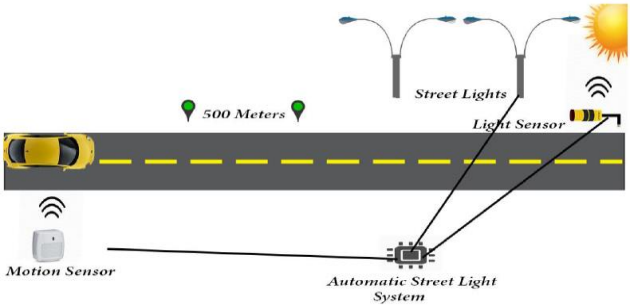

Fig 3:- Practical Prototype Model

In figure 3 there is some practical example of our model which makes it clear more that how our model will work with help of sensors. UPPAAL, the main issue was to test the model into the UPPAAL for verifying that possibility of this model to work in real life. So, we have made two models in UPPAAL one with name of Environment and one with name of Streets lights as shown to the figure 4 and 5.

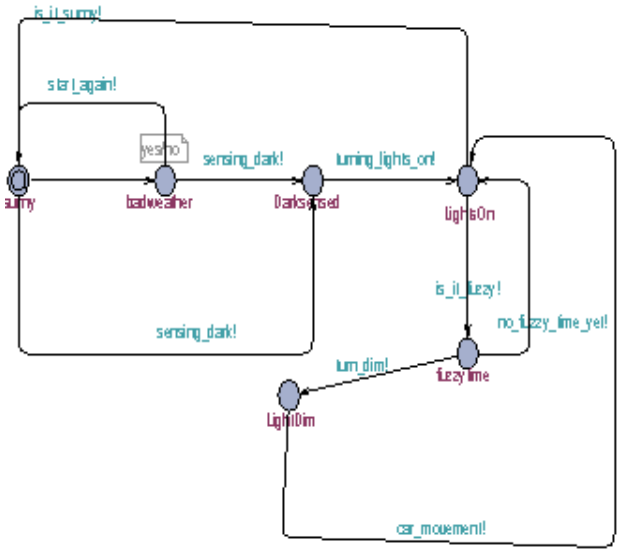

Fig 4:- Environment Model using Uppaal

The environment model tells us the system will start from the sunny and then sends the signal to the Darkened whether it will be from bad weather of or from the night. Once it sensed the dark the system will turn on the lights as we can see above in the diagram, afterwards it will wait for the fuzzy time to active which is the unknown value of time it could be 10:00pm or 12:00pm as I have explained fuzzy logic before, when system gets the fuzzy time it will make light dim because of the no traffic or vehicle during the mid-night which make our system to save huge amount of energy and then it will wait for the car to move and once the system detect any car movement from the sensor it will turns light back on.

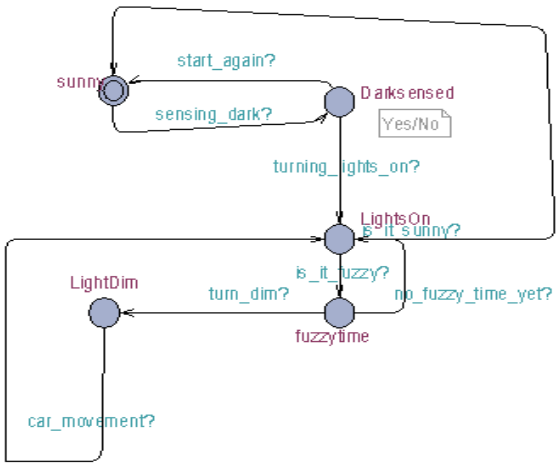

Fig 5:- Street Light Model using Uppaal

Figure 5 is the model of street lights connecting itself with the environment model moreover it explains the methodology bit more. The fuzzy time is waiting for the system to tell that it got the fuzzy value if yes then it will make the lights dim or else will stays on the state of lights on.

IV. EXPERIMENTS AND RESULTS

With the assistance of UPPAAL we were able to test our model which helped us to know that our model is qualified to imply to the real life. This tool helped us to conduct some random states where we saw some useful random states given by the UPPAAL as shown in the figure 6.

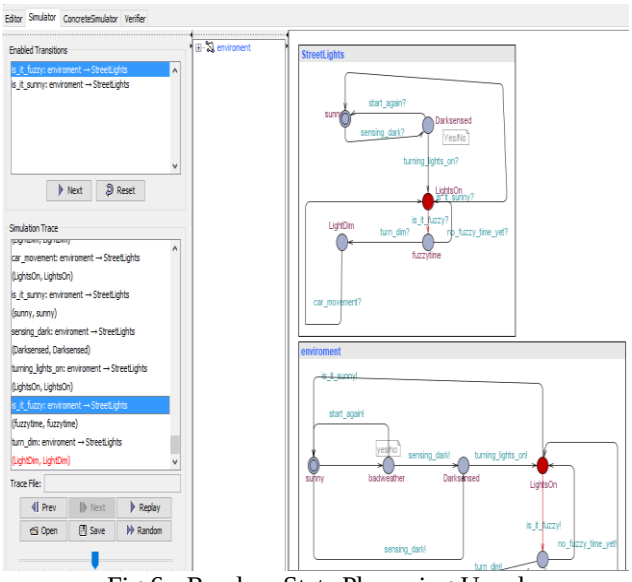

Fig 6:- Random Stats Play using Uppal

These random states play shows us how our model will work in different states provided by this test tool and we even witness many of the new possibilities which we didn't think before and here are some results that we have verified with the help of Uppaal tool

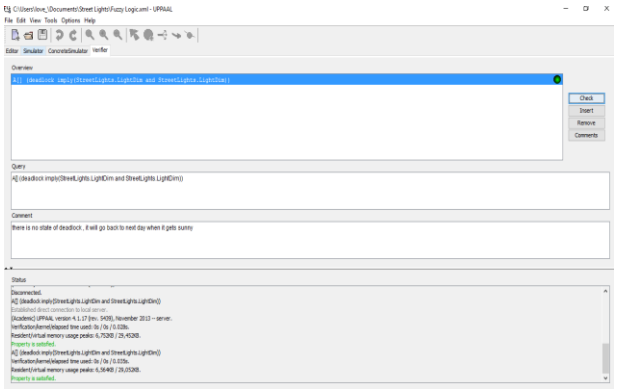

Fig 7:- First property Satisfied

We verified by interning the Query that our model is not in the deadlock from top to bottom, hence its proved that model can deploy practically in the real life.

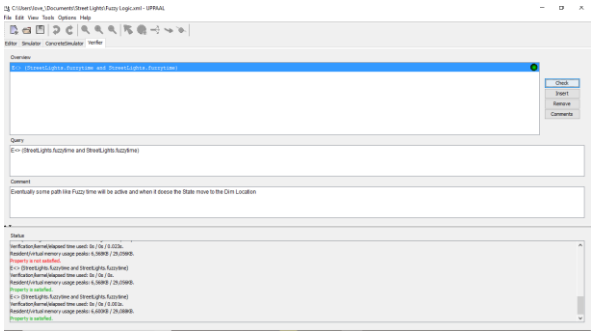

Fig 8:- Eventually Some path fuzzy time

When the fuzzy time active then the system will move towards the Light dim which we have also verified it with the help of the query.

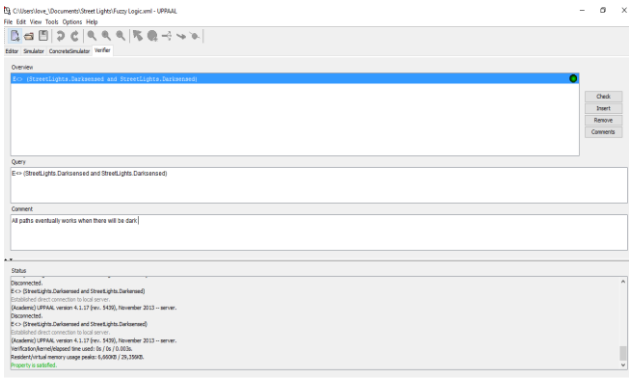

Fig 9:- Eventually the Darkened

Eventually Dark sense is the only locations or state when it will be active then the system will move further or it will stay in the sunny forever in the sunny.

V. CONCLUSION

In nations like Pakistan, where control keeps on residual an extravagance for some, such sort of a road lighting framework will go far in helping us to spare vitality as the lights will naturally turn off, once the vehicle has cruised by.

The vitality emergency in Pakistan. The reason is basic: the interest for power in Pakistan surpasses supply by 5,0000 MW So if we introduced this sort of model we not only can save the huge amount of light but we avoid numbers of accidents due to the dark light occurred by the bad weather.

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